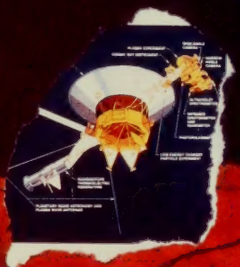
GRADUATE SCHOOL CATALOG

UNIVERSITY OF MARYLAND AT COLLEGE PARK



1990-1991







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GRADUATE CATALOG

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1990-1991



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A Guide to Graduate Programs

Graduate Program (course code)	Degrees Offered	Page	Graduate Studies Office and Telephone
Aerospace Engineering (ENAE)	M.S., Ph.d.	77	Rm. 0151 Engineering Classroom Bldg. 405-1121
Agricultural & Extension Education (AEED)	M.S., Ph.D. A.G.S. Certificate	78	Rm. 0220, Symons Hall 405-1255
Agricultural & Resource Economics (AREC)	M.S., Ph.D.	79	Rm. 2200, Symons Hall 405-1291
Agricultural Engineering (ENAG)	M.S., Ph.D.	81	Rm. 1130 Shriver Lab 405-1198
Agronomy (AGRO)	M.S., Ph.D.	82	Rm. 1109, H.J. Patterson Hall 405-1306
American Studies (AMST)	M.A., Ph.D.	83	Rm. 2140, Taliaferro 405-1354
Animal Sciences (ADVP)	M.S., Ph.D.	85	Rm. 2131, Animal Science Bldg. 405-1391
Anthropology (ANTH)	M.A.A.	86	Rm. 1111, Woods Hall 405-1423
Applied Mathematics (MAPL)	M.A., Ph.D.	87	Rm. 1108 Mathematics Bldg. 405-5062
Architecture (ARCH)	M.Arch	90	Rm. 1298, Architec. Bldg. 405-6284
Art History (ARTH)	M.A., Ph.D.	92	Rm. 1211, Art/ Soc. 405-1479
Art (ARTT)	M.F.A.	94	Rm. 1211E, Art/ Soc. 405-1442
Astronomy (ASTR)	M.S., Ph.D.	95	Rm. 1231, Computer & Space Sciences Bldg. 405-3001
Biochemistry (BCHM)	M.S., Ph.D.	97	Rm. 1320, Chemistry Bldg. 405-1796
Botany (BOTN)	M.S., Ph.D.	98	Rm. 3236, H.J. Patterson Hall 405-1649
Business & Management (BMGT)	M.S., M.B.A., Ph.D	99	MBA Coordinator Rm. 3104, Tydings Hall 405-2278

Business/Law Combined (LMBA)	M.B.A., J.D.	102	Rm. 3104, Tydings Hall 405-2278
Business/Public Affairs (BMPM)	M.B.A., M.P.M.	102	Rm. 3104, Tydings Hall 405-2278
Chemical Engineering (ENCH)	M.S., Ph.D.	103	Rm. 1223B, Chemical Engr. Bldg. 405-1935
Chemical Physics (CHPH)	M.S., Ph.D.	104	Rm. 2120, Inst. for Physical Science & Technology 405-4781
Chemistry (CHEM)	M.S., Ph.D.	106	Rm. 1320 Chemistry Bldg. 405-1796
Civil Engineering (ENCE)	M.S., Ph.D.	107	Rm. 1179, Engineering Classroom 405-1980
Classics (CLAS)	M.A.	108	Rm. 4220, Jimenez Hall 405-2013
Community Planning (CMPL)	M.C.P.	207	Rm. 1117 LeFrak Hall 405-6790
Comparative Literature (CMLT)	M.A., Ph.D.	109	Rm. 4220, Jimenez Hall 405-3809
Computer Science (CMSC)	M.S., Ph.D.	111	Rm. 1105, Computing & Space Sciences Bldg. 405-2664
Counseling & Personnel Services (EDCP)	M.Ed., M.A., Ph.D. Integrated Master's AGS Certificate	113	Rm. 1210, Benjamin Bldg. 405-2858
Creative Writing (CRWR)	M.F.A.	126	Rm. 1133 Taliaferro Hall 405-3798
Criminal Justice & Criminology (CRIM)	M.A., Ph.D.	116	Rm. 2220, LeFrak Hall 405-4699
Curriculum & Instruction (EDCI) AGS Certificate	M.Ed., M.A. Ed.D., Ph.D.	117	Rm. 1210, Benjamin Bldg. 405-3324
Dance (Dance)	M.F.A.	118	Rm. 1116, Bldg. EE/058 405-3180
Economics (ECON)	M.A., Ph.D.	120	Rm. 3115J, Tydings Hall 405-3512
Education Policy, Planning & Administration (EDPA)	M.A., M.Ed., Ed.D., Ph.D, AGS Certificate	121	Rm. 1210, Benjamin Bldg. 405-3574
Electrical Engineering (ENEE)	M.S., Ph.D.	122	Rm. 3179B, Engineering Classroom Bldg. 405-3681

Engineering Materials (ENMA)	M.S., Ph.D.	125	Rm. 1110, Chemical Engr. Bldg. 405-5207
English Language & Literature (ENGL)	M.A., Ph.D.	126	Rm. 1133, Taliaferro 405-3798
Entomology (ENTM)	M.S., Ph.D.	127	Rm. 1330B, Symons Hall 405-3912
Family & Community Development (FMCD)	M.S.	128	Suite 1204, Marie Mount Hall 405-3672
Fire Protection Engineering (ENFP)	M.S.	130	Rm. 0147, Eng. Classroom Bldg. 405-3991
Food Science (FDSC)	M.S., Ph.D.	131	Rm. 2113, Animal Science Center 405-1377
French Language & Literature (FRIT)	M.A., Ph.D.	133	Rm. 3122, Jimenez Hall 405-4024
Geography (GEOG)	M.A., Ph.D.	134	Rm. 1173, LeFrak Hall 405-4057
Geography/Library & Information Services (GELS)	M.A., M.L.S.	135	Rm. 4110, Hornbake Library 405-2038
Geology (GEOL)	M.S., Ph.D.	136	Rm. 4103, Geology Bldg. 405-4365
Germanic Language & Literature (GERS)	M.A., Ph.D.	137	Rm. 3215 Jimenez Hall 405-4091
Government & Politics (GVPT)	M.A., Ph.D.	138	Rm. 2181F, LeFrak Hall 405-4161
Health Education (HLTH)	M.A., Ph.D.	139	Rm. 2387, Physical Education, Recreation and Health 405-2464
Hearing & Speech Science (HESP)	M.A., Ph.D.	140	Rm. 0100, LeFrak Hall 405-4214
History (HIST)	M.A., Ph.D.	142	Rm. 2115, Francis Scott Key Hall 405-4264
History/Library & Information (HILS)	M.A., M.L.S.	145	Rm. 4110, Hornbake Library 405-2038
Horticulture (HORT)	M.S., Ph.D.	146	Rm. 2109A, Holzapfel Hall 405-4357
Human Development (EDHD)	M.Ed., M.A., Ed.D., Ph.D., AGS Certificate	147	Rm. 1210, Benjamin Bldg. 405-2354

Human Nutrition & Food Systems (HNFS)	M.S., Ph.D.	149	Rm. 1204, Marie Mount Hall 405-4928
Industrial, Technological & Occupational Education (EDIT)	M.Ed., M.A., Ed.D., Ph.D., AGS Certificate	150	Rm. 1210, Benjamin Building 405-4539
Journalism (JOUR)	M.A.,(Ph.D. see Public Communication)	152	Rm. 2104, Journalism 405-2380
Kinesiology (KNES)	M.A., Ph.D.	153	Rm. 2343, Phys. Ed., Recreation & Health Bldg. 405-2455
Law/Public Management Combined (LMPM)	M.P.M., J.D.	189	Suite 2102B, Morrill Hall 405-6330
Library & Information Services (LBSC)	M.L.S., Ph.D.	155	Rm. 4110, Hornbake Library 405-2038
Linguistics (LING)	M.A., Ph.D.	158	Rm. 1101, Mill Bldg. 405-7002
Marine-Esturine-Environmental Sciences (MEES)	M.S., Ph.D.	159	Rm. 0313, Symons Hall 405-5343
Mathematical Statistics (STAT)	M.A., Ph.D.	161	Rm. 1108, Mathematics Bldg. 405-5061
Mathematics (MATH)	M.A., Ph.D.	162	Rm. 1108, Mathematics Bldg. 405-5058
Measurement, Statistics and Evaluation (EDMS)	M.A., Ph.D.	165	Rm. 1210, Benjamin Bldg. 405-2354
Mechanical Engineering (ENME)	M.S., Ph.D.	166	Rm. 2168, Eng. Classroom Bldg. 405-4216
Meterology (METO)	M.S., Ph.D.	169	Rm. 2227, Computer & Space Science Bldg. 405-5373
Microbiology (MICB)	M.S., Ph.D.	172	Rm. 3117, Micorbiology Bldg. 405-5435
Molecular and Cellular Biology (MOCB)	Ph.D.	173	Rm. 2504, Chemistry Bldg. 405-1407
Music (MUSC)	M.M., D.M.A. Ph.D.	175	Rm. 1219C, Tawes Fine Arts Bldg. 405-5870

Nuclear Engineering (ENNU)	M.S., Ph.D.	178	Rm. 2309, Chemical Engineering 405-5208
Nutritional Sciences (NUSC)	M.S., Ph.D.	179	Rm. 1108B, Marie Mount Hall 405-2371
Philosophy (PHIL)	M.A., Ph.D.	179	Rm. 1117, Skinner Hall 405-5693
Physics (PHYS)	M.S., Ph.D.	181	Rm. 1302D, Physics & Astr. Bldg. 405-5982
Policy Studies (POSI)	Ph.D.	188	Suite 2102B, Morrill Hall 405-6330
Poultry Science (POUL)	M.S., Ph.D.	184	Rm. 3129, Animal Science Bldg. 405-5775
Psychology (PSYC)	M.S., M.A., Ph.D.	185	Rm. 1220, Zoo-Psych Bldg. 405-5865
School of Public Affairs (PUAF) (Public Management, and Public Policy)	M.P.M., M.P.P.	187	Suite 2102B, Morrill Hall 405-6330
Public Communication (PCOM)	Ph.D.	190	Rm. 1206, Tawes Fine Arts Bldg. 314-9573
Radio & Television & Film (RTVF)	M.A. (Ph.D., see Public Communication)	192	Rm. 0123 Tawes Fine Arts Bldg. 405-6261
Recreation (RECR)	M.A., Ph.D.	193	Rm. 2363, Phys. Ed. & Health 405-2461
Reliability Engineering (ENRE)	M.S., Ph.D.	194	Rm. 2113 Chemical Eng. Bldg. 405-5208
Russian Language, Linguistics, Literature (RUSS)	M.A.	195	Rm. 3215 Jimenez Hall 705-4091
Sociology (SOCY)	M.A., Ph.D.	196	Rm. 2103 Art/Soc. Bldg. 405-6390
Spanish Language & Literature (SPAP)	M.A., Ph.D.	197	Rm. 2215, Jimenez Hall 405-6446
Special Education (EDSP)	M.Ed., M.A., Ed.D., Ph.D., AGS Certificate	199	Rm. 1210, Benjamin Hall 405-6515
Speech Communication (SPCM)	M.A. (Ph.D., see Public Communication)	201	Rm. 0148A Tawes Fine Arts Bldg. 314-9573

Systems Engineering (ENSE)	M.S.	203	Rm. 2101, A.V. Williams Bldg. 405-6573
Textiles and Consumer Economics (TXCE)	M.A., Ph.D.	203	Rm. 1204. Marie Mount Hall 405-6657
Theatre (THET)	M.A., M.F.A., Ph.D.	205	Rm. 0240 Tawes Fine Arts Bldg. 405-6676
Toxicology (TOXI)	M.S., Ph.D.	206	Rm. 0300, Symons Hall 405-7134
Urban Studies (URBS)	M.A., M.C.P.	207	Rm. 1117, LeFrak Hall 405-6790
Zoology (ZOOL)	M.S., Ph.D.	209	Rm. 2231, Zoo-Psych Bldg. 405-6905

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Campus Map

General Information

Admission to Graduate School

General

Responsibility for admitting applicants to graduate programs rests with the Dean for Graduate Studies and Research. Academic department and program officers along with faculty committees review admissions applications and credentials and make admissions recommendations to the Dean. In the cases where credentials were earned abroad, the staff of the International Education Services is consulted. The standards maintained by the Graduate School and individual departments and programs are applied to ensure that applicants admitted to the University are well qualified and trained to study at this institution and have a reasonable expectation of successfully completing a graduate program. Standards for admission to doctoral degree programs are frequently higher than those for admission to master's degree programs. In many degree programs, the number of applications received from qualified applicants for graduate study regularly exceed the number of applicants who can be accommodated. In such cases, only the most highly qualified are offered admission. The number of spaces available in various departments is limited according to the availability of faculty, special resources and funds for students requiring financial assistance.

Criteria for Admission

Those who have earned or will earn a bachelor's degree at a regionally accredited college or university in the United States, or the equivalent of this degree in another country, will be considered for admission to the Graduate School at UMCP.

The decision to admit an applicant to a program is based primarily on a combination of the following criteria according to the requirements of a specific program or department.

1. **Quality of previous undergraduate and graduate work.** *The Graduate School requires as a minimum standard a B average or 3.0 on a 4.0 scale, in a program of study resulting in the award of a baccalaureate degree from a regionally accredited college or university.* If an applicant has studied at the graduate level elsewhere, less weight may, but not necessarily, be placed on the quality of the undergraduate academic record. Some programs may require a higher minimum grade average for admission.
2. **Strength of letters of recommendation from persons competent to judge the applicant's probable success in graduate school.** These letters are usually from the applicant's former professors who are able to give an in-depth evaluation of the applicant's strengths and weaknesses with respect to academic work. Additional recommendations may come from employers or supervisors who are familiar with the applicant's work experience. Applicants should instruct their references to send all letters of recommendation directly to the program in which they desire entrance.

3. **Scores on a nationally standardized examination.** The three most widely used standardized examinations are the Graduate Record Examinations, Graduate Management Admissions Test and the Miller Analogies Test. Because the predictive utility of these test scores may vary from one group of applicants to another, a discriminating use of all relevant materials will be made in each applicant's case.

   For information on the programs that require one of these tests, please see the List of Graduate programs in this catalog and the instructions that accompany application forms.
4. **Statement by the applicant of academic career objectives and their relation to the intended program of study.** These statements help the department or program identify students whose goals are consonant with its objectives.
5. **Other evidence of graduate potential.** Some programs require other evidence of graduate potential, such as a portfolio of creative work, completion of specialized examinations or personal interviews.

Notes about Eligibility for Admission

1. Prospective students may apply for admission to the University of Maryland during or after their final year of undergraduate study but must furnish proof of graduation before the end of their first term of enrollment at the University.
2. Prospective students applying for admission to a graduate degree program in a field of specialization in which they already hold that same degree or its equivalent may do so only if the previous degree program was of substantially different character or was not accredited.
3. Prospective Summer only-Students applying for entrance in either of the two summer sessions should check the Summer Sessions Bulletin to determine if the courses they wish to take will be offered. To obtain this publication, write to Summer Sessions Office, University of Maryland, College Park, MD 20742.
4. a. ***Non-U.S. Citizens*** who are legal permanent residents of the U.S. and/or immigrants may use regular applications for admission. To assure full consideration, all credentials accompanied by English language translations for all documents not written in English must be received by the Graduate School at least three months prior to the first day of classes of the semester for which the applicants are seeking admission.

   b. ***Foreign applicants*** (i.e., applicants who are not permanent residents of the U.S. and/or immigrants) must use the International Student Application Form obtainable from the Office of Graduate Admissions, Graduate School, University of Maryland, College Park, MD 20742. To assure full consideration, all credentials accompanied by English language translations for all documents not written in English must be received by the Graduate School at least seven months prior to the first day of classes of the semester for which the applicants are seeking admission.

Categories of Admission to Degree programs

Applicants for degree programs may be admitted to either full or provisional status as outlined below:

Full Graduate Status

Students admitted to full graduate status must have submitted official documents indicating a completed baccalaureate degree from a regionally accredited institution and be otherwise fully qualified in the judgment of the individual program and the Graduate School.

Provisional Graduate Status

Students may be admitted to provisional status because:

1. The previous academic record is borderline or the prerequisite coursework in the chosen field is insufficient; or
2. The applicant has majored in another field with a creditable record but has not yet clearly demonstrated abilities in the proposed new field; or
3. The applicant has completed the baccalaureate degree but has not yet submitted official verification of the last semester's work and receipt of the degree.

Official transcripts indicating receipt of the degree must be submitted before the end of the first semester.

Non-degree Admission Categories

Advanced Graduate Specialist Certificate Status

The Advanced Graduate Specialist Program is designed to promote a high level of professional competence in an area of specialization in the field of education. The candidate must be able to show that he or she can operate as an effective counselor, administrator, teacher or skilled person in a major field of professional endeavor. The Advanced Graduate Specialist Certificate is offered through most of the programs in the College of Education and the Agricultural and Extension Education program in the College of Agriculture. The Certificate is awarded by the College of Education or by the College of Agriculture. Requirements are as follows:

1. Applicants must meet the same general criteria for admission as those prescribed for degree seekers. Additionally, the applicant must have completed a master's degree or the equivalent in credits earned either at the University of Maryland or at another regionally accredited institution. The Miller Analogies Test scores are required at the time of application.
2. Coursework totaling not more than 30 credits with grades of at least a "B" from an accredited institution may be transferred to the program at the University of Maryland.
3. The program must be developed in cooperation with an adviser and filed with the Graduate Studies office in the College of Education.
4. The Advanced Graduate Specialist Certificate program requires a minimum of 60 semester hours of credit with not less than 30 semester hours of credit completed with the University of Maryland. At least one half of the credits earned either at other institutions or at the University of Maryland must be in courses comparable to those in the 600-800 series. The student may be required to take a substantial portion of the program in departments other than those in the College of Education or the College of Agriculture. Registration in certain kinds of field study, field experience, apprenticeship or internship may also be required.

There will be a written examination of not less than six hours. A "B" average with no "D" or "F" grades will be required before the certificate can be awarded.

For additional details see "Statement of Policies and Procedures; Advanced Graduate Specialist Program in Education," issued by the College of Education.

Advanced Special Student Status

The Advanced Special Student Status is designed to provide an opportunity to individuals who do not have an immediate degree objective in mind to take graduate level courses. Although the primary mission of the Graduate School is to conduct programs of graduate instruction leading to advanced degrees, the Graduate Faculty welcomes qualified students who have no degree objectives to the extent that resources allow. Unofficial transcripts or photocopies of diplomas will be accepted with the application for evaluation purposes, but by the end of the first semester of enrollment, the student must submit official copies of all required documents. Official transcripts must be submitted from all institutions except the University of Maryland, College Park.

Applicants for admission to Advanced Special Student Status must satisfy one of the following criteria:

1. **Hold a baccalaureate degree from a regionally accredited institution with an overall "B" (3.0) average.** Applicants must submit official transcripts covering all credits used in satisfying the baccalaureate degree requirements.
2. **Hold a master's or doctoral degree from a regionally accredited institution.** Applicants must submit an official transcript showing the award of a master's or doctoral degree.
3. **Hold a baccalaureate degree from a regionally accredited institution and have at least four years of successful post-baccalaureate work or professional experience.** Applicants must submit an official transcript showing the award of the baccalaureate degree.
4. **Achieve a score that places the applicant in the upper 50 percentile of appropriate national standardized aptitude examinations such as the Graduate Record Examination Aptitude Test, the Miller's Analogies Test, the Graduate Management Admissions Test.** Where different percentiles are possible, the Graduate School will determine which score is acceptable.

Admission to Advanced Special Student Status will normally continue for ***five years***. If there is no registration in ***three consecutive academic semesters***, the admitted status will lapse and a new application will be required.

Advanced Special Students must maintain a 2.75 grade point average.

Advanced Special Students must pay all standard graduate fees. Students in this status are not eligible to hold appointments as Graduate Teaching or Research Assistants or Fellows, or receive other forms of financial aid. All other services, e.g. parking, library privileges, etc., are the same as those accorded to other graduate students. Advanced Special Student status is not available to those on "F" (student) or "J" (exchange visitor) visas.

Admission to Advanced Special Student Status is not intended to be used as a preparatory program for later admission to a doctoral or master's program nor to the Advanced Graduate Specialist Certificate program. Consequently, no more than six credits earned while in this status may be applicable to a degree or certificate program at a later time, with the approval of the faculty in the desired program, if the student is subsequently accepted for degree or certificate study. For consideration of admission to a degree program at a later time, the student must submit a new application.

Visiting Graduate Student Status

A graduate student matriculated in another graduate school who wishes to enroll in the Graduate School of the University of Maryland at College Park and who intends to return to the graduate school in which he or she is matriculated, may be admitted as a Visiting Graduate Student.

Criteria for enrollment as a visitor are admission to and good standing in another recognized graduate school. The applicant need not submit full transcripts of credits but must apply for admission to the UMCP Graduate School and pay the application fee. In lieu of transcripts, a student may have the graduate dean of the home institution certify to the Graduate School in writing that the student is in good standing and that the credits will be accepted toward the graduate degree. Unless otherwise specified, admission will be offered for one year only.

Golden Identification Card for Senior Citizens of Maryland

The purpose of this status is to make available without charge courses and services of the University's campuses to citizens who are 60 years of age or older, who are residents of the State of Maryland and who are retired (retired persons will be considered those who affirm that they are not engaged in gainful employment for more than 20 hours per week). People meeting these requirements may apply for graduate admission either as degree or nondegree students, and they must meet the same admissions criteria pertaining to either category as do all applicants. Once admitted and issued the Golden Identification Card, people may register for courses in any sessions, subject to the same restrictions as any other student, and use the library and other campus facilities during the time they are enrolled in courses. Tuition fees will be waived for Golden Identification Card holders.

Admission to an Institute

Application for admission to an institute should be made directly to the director of the institute. If admission to the Graduate School is also necessary, the decision will be based on the same criteria for admitting other degree applicants. Admission to an institute does not imply that the individual will be automatically admitted in any other status at the University of Maryland at a later date. The status terminates upon completion of the institute in which the student was enrolled. A new application must be submitted for admission to any other graduate status or program.

Students already admitted to a regular graduate degree or nondegree status may also qualify for participation in an institute.

Offer of Admission

Applicants admitted to the Graduate School will receive a written offer of admission from the Graduate School that specifies the date of entrance. The offer of admission

requires a response. If the applicant wishes to accept, decline or change the effective date of the offer, the Graduate School must be notified or the offer of admission becomes void. Failure to register for the authorized term also voids the offer of admission. If the offer is voided, the applicant must submit another application and may be required to submit additional credentials in order to be considered for admission in a subsequent semester.

Graduate students must consult their academic department for precise registration information.

Change of Status or Program

Students are admitted only to specified programs for specified objectives. New applications are required under the following conditions:

1. If the student wishes to change programs (students may be admitted to only one graduate program at any one time); or
2. If the student wishes to change status (from nondegree to degree); or
3. If the student wishes to pursue a new degree objective (change from master's to doctoral degree).

Admission to a new program and/or status is not granted automatically. Each application is subject to approval.

Termination of Admission Status

A student's admission terminates when the time limits for completion of the degree or nondegree status have been exceeded or when the student is no longer in "good standing". Students must maintain an average grade of B or better in all graduate courses taken and must otherwise satisfy all additional departmental and Graduate School program requirements. The admission of all students, both degree and nondegree, is continued at the discretion of the major professor, the department or program director and the Dean for Graduate Studies.

The Admission Process

To be considered for admission to the University of Maryland College Park Graduate School each applicant must obtain and complete the application form following all instructions. An application may be obtained by writing directly to the Graduate School, Lee Building, University of Maryland, College Park, MD 20742.

Each applicant must submit the following items in order to be considered for admission:

1. A completed application form.
2. An application fee of twenty five dollars (do not send cash).
3. Two complete sets of transcripts reflecting all undergraduate and graduate work elected or in progress. Each transcript must bear the signature of the registrar and the seal of the granting institution and should include the years of attendance, courses taken, grades received, class standing and the degree, certificate or diploma received. If the applicant attended UMCP, the Graduate School will obtain your records of courses completed on the College Park campus. To facilitate the processing and review of an application, send two sets of unofficial copies of transcripts from institutions other than the University of Maryland College Park Campus. Official copies of those transcripts are required before full admission can be granted.

4. Three letters of recommendation submitted by professors or others who can assess the quality of the applicant's academic performance and scholastic potential. Letters of recommendation should be sent directly to the academic department in which the applicant is interested. Be certain that the applicant's full name is included on each recommendation.
5. Each applicant must prepare a 300-500 word statement of her/his goals and objectives in pursuing graduate study.
6. **Standardized Test Scores** Many departments and programs require applicants to submit scores of standardized examinations, such as the Graduate Record Examination (GRE), the Graduate Management Admission Test (GMAT) or the Miller Analogies Test (MAT). To determine if one of these examinations is required for admission to the department or program to which you are applying, please consult the listing at the end of the brochure. If standardized test scores are required, you may write to the following addresses for further information:

   Graduate Record Examinations
   CN 6004 Educational Testing Services
   Princeton, NJ 08541-6004 USA

   Graduate Management Admissions Test
   Box 966
   Princeton, NJ 08541 USA

   Miller Analogy Test
   Psychological Corporation
   7500 Old Oak Blvd.
   Cleveland, OH 44130 USA

   Examination scores should be sent directly to the department or program to which you are applying.
7. **Departmental Requirements** Some departments and programs require additional information such as a portfolio or other supplementary materials. It is important that applicants contact the department or program to which they are applying for information concerning additional admission requirements. Failure to do so may result in an application not being considered.

Calculation of Grade Point Average

All applicants must calculate separate grade point averages for the following categories: (1) all courses taken for the baccalaureate; (2) all credits earned after the first 60 credits for the baccalaureate; (3) credits that constitute the undergraduate major; and (4) all credits taken beyond the bachelor's degree. All grades are to be converted to a four-point grading system. Pass/fail, satisfactory, completed credit and similar grades are not included in these calculations. Except as already noted, all numerical, alphabetical or equivalent grades must be calculated as follows:

a. Multiply quarter credit hours by (.66) to convert to semester credit hours.
b. Multiply the number of semester credit hours for each course by the number of quality or honor points earned, as follows: A = 4; B = 3; C = 2; D = 1; F = O.

c. Divide the total number of quality points by the total number of semester credit hours. The quotient will be your grade point average.

Admission of Faculty

No member of the faculty employed by the University of Maryland who has the rank of assistant professor or above is permitted to enroll in a program leading to an advanced degree at this institution. Faculty who wish to take coursework for personal enrichment may want to investigate the Advanced Special Student Status.

Application Deadlines

Applicants should pay special attention to the deadlines listed in each application booklet. It is generally to the applicant's advantage to apply well before the published deadline, particularly if the applicant wishes to be considered for fellowships, assistantships or other forms of financial aid. The Graduate School recommends that applicants time the submission of their applications, transcripts and letters of recommendation to arrive before February 1. Applicants are solely responsible for making certain their transcripts have been received by the Graduate School.

If possible, the application should arrive before the transcripts and other supporting evidence of preparation if these materials cannot be attached to the application.

Application deadline information for the Fall and Spring Semesters is listed below:

1. Fall (Aug.) and Spring (Jan.) Semesters: Each department, in consultation with the Graduate School, sets its own deadlines for Fall semester entrances for U.S. citizens, resident aliens and refugees.
2. International Students: All citizens of foreign countries must submit applications for admission by the following dates:
   a. Fall-February 1 of prior academic year (unless the department in which you are interested sets an earlier deadline).
   b. Spring-June 1 of prior academic year.

Summer School

Students applying for entrance in either of the two summer sessions are urged to check the *Summer Sessions Bulletin* to determine if the courses they wish to take will be offered in a particular session. To obtain this publication, write to Summer Sessions Office, University of Maryland, College Park, MD 20742.

International Students

Foreign students seeking admission to the University of Maryland should not plan to leave their country before receiving an official offer of admission from the Graduate School.

1. All citizens of foreign countries must submit applications for admission in accordance with stated deadlines.
2. **Special Notes** for International Students:
   a. *Academic Credentials:* The complete application and official transcripts or mark sheets with English translations must be received in the Graduate Admissions Office prior to stated deadlines.

b. *English proficiency:* Applicants must demonstrate English language proficiency by taking the Test of English as a Foreign Language (TOEFL) since all foreign students are expected to read, speak, understand and write English fluently.

c. *Financial Resources:* Each applicant must furnish a statement of financial status to the Office of International Education Services. Approximately $13,750.00 is required for educational and living expenses each year.

d. *Immigration Documents:* Applicants admitted for graduate study will be issued a student visa where appropriate.

e. *Non-U.S. Citizens* should address any questions to the Director, International Education Services, University of Maryland, College Park, MD 20742, USA.

Reporting Upon Arrival:

Every foreign student is expected to report to the Office of International Education Services in the Mitchell Building as soon as possible after arrival at the University. This Office will be able to assist not only with various problems regarding immigration, housing and fees, but also with problems relating generally to orientation to university and community life. Questions concerning criteria and requirements for foreign applicants should be addressed to the Director, International Education Services, University of Maryland, College Park, MD 20742.

Records Maintenance and Disposition

All records including academic records from other institutions, become part of the official file and can neither be returned nor duplicated for any purpose. Students should obtain an additional copy of their official credentials to keep in their possession for advisory purposes and for other personal requirements.

The admission credentials and the application data of applicants are retained for 18 months only and then destroyed in the following cases: 1) Applicants who do not register for courses at the time for which they have been admitted; 2) Those whose applications have been disapproved; 3) Applicants who do not respond to the departmental requests for additional information; and 4) Those whose applications are not complete with respect to the receipt of all transcripts or test results.

Fees and Expenses

Graduate Fees*

Application fee $25.00

A non-refundable $25 application fee and a separate application must be submitted for each program in which entrance is sought.

The University is pleased to waive the application fee if the student has been admitted to and has attended the University of Maryland, College Park Graduate School previously.

Tuition Per Credit Hour:(Academic year 1990-91)

Resident Student	$128.00
Non-Resident Student	$229.00

Students admitted to the Graduate School must pay graduate tuition fees whether or not the credit will be used to satisfy program requirements. A graduate student who wishes to audit a course must pay the usual graduate tuition.

Continuous Registration Fee (per semester)	$10.00
Graduation Fee	
Master's Degree	$25.00
Graduation Fee	
Doctor's Degree	$50.00
Mandatory Fees"*"	
(Students taking one to eight credits)	$88.00
(Students taking nine or more credits)	$134.50

The fees and waivers listed here are those charged at the time this Catalog went to press and are offered as a general guide. They are subject to change. Fees charged in a particular semester are published in the ***Schedule of Classes*** for that semester.

"*"For a breakdown of the "Mandatory Fees," consult the "Schedule of Classes."

Determination of In-State Status for Admission, Tuition and Charge-Differential Purposes

An initial determination of in-state status for admission, tuition and charge-differential purposes will be made by the University at the time a student's application for admission is under consideration. The determination made at that time and any determination made thereafter shall prevail in each semester until the determination is successfully challenged. ***The deadline for meeting all requirements for an in-state status and for submitting all documents for reclassification is the last day of registration for the semester the student wishes to be classified as an in-state student.***

The volume of requests for reclassification may necessitate a delay in completing the review process. It is hoped that a decision in each case will be made within ninety (90) days of a request for determination. During this period of time, or any further period of time required by the University, fees and charges based on the previous determination must be paid. If the determination is changed, any excess fees and charges will be refunded.

Persons who are interested in obtaining a copy of the regulations or who want assistance with their classification should contact: Office of Residency Classification, Room 0405B Marie Mount Hall, University of Maryland, College Park, Maryland 20742.

Payment of Fees - See Schedule of Classes for detailed information.

Registration is not completed or official until all financial obligations are satisfied. Although the University regularly mails bills to students, it cannot assume responsibility for their receipt. If a student does not receive a bill on or before the beginning of each

semester, it is the student's responsibility to obtain a copy of the bill at Room 1103, Lee Building, 8:30-4:15, Monday through Friday.

The University of Maryland does not have a deferred payment plan. Payment for previous balances and current semester fees are due on or before the first day of classes. Please Note: Payments for student accounts may be made by Visa or Mastercard. Credit card payments may be made in person or by mail. However, phone-in payments will not be accepted at this time.

It is the policy of the University not to defer payment on the basis of a pending application for financial assistance to an outside agency, including Veterans Administration benefits, bank loans, guaranteed student loan programs, etc.

Students will be severed from University services for delinquent indebtedness to the University. In the event that severance occurs, the individual may make payment during the semester in which services were severed and all services except housing will be restored. A 5 percent Late Payment Fee and a $25.00 Severance of Service Fee will be assessed if payment due dates are not followed.

State of Maryland legislation has established a State Central Collections Unit, and in accordance with State law, the University is required to turn over all delinquent accounts to that office for collection and subsequent legal action. The minimum Collection Fee is 15 percent plus any attorney and/or court costs.

Refund of Fees

A Cancellation of Registration submitted to the Registrations Office before the official first day of classes entitles the student to a full credit or refund of semester tuition and fees.

After classes begin students who wish to terminate their registration must follow the withdrawal procedures stated in the "Schedule of Classes" Students will find the necessary forms for withdrawal in the Records Office. The effective date used in computing refunds is the date the withdrawal form is filed. "Stop Payment" on a check, failure to pay the semester bill, or failure to attend classes does not constitute withdrawal.

A student must file a request for a refund with the Office of the Bursar or any credit on the student account will automatically be carried over to the next semester.

Students withdrawing from the University will be credited for tuition in accordance with the following schedule:

Period from date Instruction begins	***Refundable tuition only (Additional fees non refundable)***
Two weeks or less	80%
Between two and three weeks	60%
Between three and four weeks	40%
Between four and five weeks	20%
Over five weeks	No refund

University Refund Statement

Tuition, refundable fees and refundable deposits are authorized for refund only if the student completes the prescribed withdrawal procedures or is dismissed from the

University. Residence Hall and Dining Services charges are authorized for refund only if the student completes the prescribed residence hall and dining services contract release procedures. Please refer to current "Schedule of Classes" for complete refund information and procedures.

Fellowships, Assistantships and Financial Assistance

The University of Maryland recognizes the high cost of education today and makes every effort to offer financial assistance to qualified students through a variety of programs. Seventy percent of all full-time graduate students receive financial support, which may include remission of tuition fees, teaching and research assistantships, work-study support, and University and state fellowships. Referrals for on-campus or area employment opportunities for students and students' spouses are also available in various departments and in specific student service centers on campus.

Admission to a graduate degree program is a prerequisite for the award of a teaching or research assistantship, a fellowship, a traineeship, a loan or a work-study award. Please be sure that all required documents for your application for admission, as well as the application for departmental financial support, have been submitted. Some awards are made on the basis of the applicant's academic merit, others on the basis of need.

There are three campus units that administer the primary forms of financial support: the Graduate School, the individual programs and the Office of Student Financial Aid. The Graduate School processes applications for the Other Race Grants (application deadlines: early November and May). The Graduate School also has a Fellowship Information Office that lists fellowship opportunities from government agencies, foundations and industry.

The individual programs and departments award graduate teaching and research assistantships (priority application deadline: March 1) and nominate students for tuition scholarships and Graduate School Fellowships (to be considered for nomination, apply by February 1).

The Office of Student Financial Aid processes College Work-Study and National Direct Student Loans (priority date for consideration; February 15). To be considered for the priority date in the Office of Student Financial Aid, you must have submitted a completed Financial Aid Form (available at most colleges throughout the country and by request from the Office of Student Financial Aid), financial aid transcripts, if appropriate, and any other required documentation to be received by the Office of Student Financial Aid by February 15. Note that the Financial Aid Form must be sent to the College Scholarship Service in Princeton for analysis, which takes approximately four weeks.

A more detailed description of the various forms of financial assistance is given below.

Fellowships

A fellowship is an award bestowed on a student who displays academic merit and promise. Fellowships are awarded only to students admitted to a degree program at UMCP who are willing to devote full-time to their study. All fellowship applicants must

be admitted to a degree program in the Graduate School on a full-time basis to be eligible. Departments nominate students for the various fellowships; students should try to submit all material for admission by February 1 since the Fellowship competition for new students is held in February and March.

The Graduate School Fellowships are awarded annually on a competitive basis. Students cannot apply directly for the award; rather they must be nominated by the department in which they intend to enroll. The minimum stipend was $9,200 for the 1990-91 academic year; fellows also receive remission of tuition. The standard application for departmental financial aid will serve as an application for this fellowship program and should be submitted directly to the department in which admission is sought. Awards are based solely on academic merit. Fellowships may be awarded to any qualified in-state, out-of-state, or international student.

Black Graduate Student Fellowships. To help recruit, retain and graduate black graduate students, UMCP offers a fellowship program that provides multi- year support only to black citizens and permanent resident aliens. Students must be nominated by departments.

Other Race Grants This grant is intended to increase the participation of black students in graduate education at the College Park campus. Students who are first-year students and students in disciplines in which blacks are underrepresented will be given preference.

Applicants for the Other Race grant must:

1. be citizens or permanent resident aliens who are classified as Maryland residents;
2. be admitted as degree-seeking students;
3. be willing to devote full-time to their study;
4. be able to demonstrate special merit or need.

The individual educational grants vary, and have ranged from $300 - $9,000. Tuition is also remitted for up to 10 credits per semester. Students may apply for reappointment on a yearly basis for up to three years. Additional details and application materials are available from the Fellowship Office of the Graduate School.

Graduate School Tuition Scholarships

First-time graduate students in degree programs who are residents of the state of Maryland and have an undergraduate GPA of 3.75 or better from an accredited American college or university may ask their departments to nominate them for a Graduate Tuition Scholarship. Students who believe they qualify for the scholarship should mark the appropriate space on the departmentally administered financial aid form. Departments may have additional criteria, e.g., full-time status, for nomination of students in their program. Tuition scholarships are awarded on a first-come, first-served basis for as long as funds are available.

Assistantships

Offers of assistantships, which are made by the individual departments, are contingent upon the applicant's acceptance as a graduate student in a degree program by the Graduate School. Departments may set additional criteria.

Graduate Teaching Assistantships are available to qualified graduate students in many departments and programs. In addition to remission of tuition, these carry 10 or 12-month stipends ranging from $9,200 to $12,360 as of the 1990-91 academic year. Applications for assistantships should be made directly to the department in which the applicant will study.

Graduate Research Assistantships, with comparable stipends, are available in some departments on a 10 or 12-month basis. For information, contact the individual department or program.

Resident Graduate Assistantships are also available in limited numbers. In 1990-91, the 12-month stipend was $11,040, plus remission of tuition, in exchange for part-time work in undergraduate residence halls as Residence Halls staff members. These Resident Assistantships are open to both men and women. Applications for a Resident Graduate Assistantship should be made to the Office of Human Resources, Department of Resident Life, Cumberland Hall, University of Maryland, College Park, MD 20742.

Administrative Assistantships Many offices on campus currently offer graduate assistant positions. For further information, contact the Fellowships Office, the individual office or department or check employment announcements outside the Personnel Office in the Lee Building.

Work-Study Program

The College Work-Study Program, through the Office of Student Financial Aid (OSFA), offers part-time opportunities for students who demonstrate sufficient financial need. Graduate students who are awarded work-study and accept it are sent work authorization forms stating the amount they can earn during the academic year. Job openings will be listed at the Job Referral Service (JRS), Room 3120 Hornbake Building, South Wing. The student is responsible for visiting the JRS to review job listings and for setting up interviews with those departments where they are interested in working. Once hired, they must submit a Work Authorization Form to the hiring department and give a copy of the form to the JRS. The student and job supervisor must both agree on the student's work schedule, which must not conflict with the student's class schedule. Contact the JRS at 314-8324 for more information about the College Work-Study Program.

Loans and Part-Time Employment

Robert T. Stafford Student Loan. The Robert T. Stafford Student Loan (formerly the Guaranteed Student Loan) is a need-based, low interest loan program. Students must file a Financial Aid Form (FAF) to determine their eligibility. Graduate students may be eligible to borrow up to $7500 per year and a cumulative maximum amount of $54,750.

Beginning July 1, 1988, first-time borrowers for Stafford Student Loans will have an interest rate of 8 percent for the first four years of repayment and 10 percent for the remainder of the repayment period. Borrowers with unpaid balances may borrow at their previous interest rate. Repayment begins six months after graduating or ceasing to be enrolled at least half-time. Graduate eligibility is as defined by the graduate school. Full-time status is defined in the graduate catalog; 24 units equals half-time status. Applicants must also make satisfactory academic progress.

If the student is eligible according to the FAF, the student will receive accompanying information with an awards letter from the Office of Student Financial Aid to complete the loan application process. For more detailed information see the Financial Facts handbook.

SLS/PLUS. Effective August 17, 1988, all students applying for a Supplemental Loan for Students (SLS) are required to complete a FAF processed by the College Scholarship Service (CSS) in order to determine if the student is eligible for a Stafford Student Loan. Beginning July 1, 1988, first-time borrowers have a variable interest rate starting at 12 percent. This rate is determined each year.

Applicants for the SLS must be independent (self-supporting), admitted to the University, a U.S. citizen or an eligible non-citizen, enrolled at least half- time and making satisfactory academic progress.

Repayment usually begins 60 days after receipt of the check. Certain lenders will defer payment until the student graduates or is no longer enrolled at least half-time. Students must make specific arrangements with their lenders for deferment. Plus loans are for parents of dependent students. A FAF is not required.

Applications for Plus or SLS can be obtained at the Public Inquiry counter of the Office of Student Financial Aid, Room 2130 Mitchell Building. For more detailed information, see the Financial Facts handbook.

Job Referral Service. The Job Referral Service, an extension of the Office of Student Financial Aid, serves without charge as a clearinghouse for students seeking part-time, temporary and summer employment opportunities. Positions are available both on and off campus. All currently enrolled University of Maryland at College Park or University College students seeking work are welcome to visit the office and consult referral lists. Additional information may be obtained from Room 3120 of the Hornbake Building, South Wing, or by calling 314-8324.

Veterans Benefits

Students who attend the University under the Veteran's Education Assistance Act may receive assistance and enrollment certification at the Veterans Certification Office in Rm. 1118 Mitchell Building. The staff is available to help with monthly educational assistance checks as well as other benefits such as tutoring assistance. Telephone 314-8237.

Registration and Credits

Registration for courses is ongoing during most of the time that the University is in session. Information concerning registration procedures, deadlines and current tuition and expenses is found in the "Schedule of Classes," published regularly by the Office of Registration and Records. Students interested in summer session courses should obtain the Summer Session "Schedule of Classes," from the Office of Summer Sessions, Reckord Armory.

Academic Calendar

The Academic Calendar is printed in the "Schedule of Classes" for each semester. The Graduate School has an "Important Dates" card for graduate students, which lists deadlines for submitting requirements for degrees in a particular academic year.

Developing a Program

The student is responsible for ascertaining and complying with the rules and procedures of the Graduate School and all applicable department or graduate program requirements that govern the individual program of study.

Registration for the newly admitted graduate student seeking a degree or certificate begins with a visit to the student's academic adviser in the graduate program or department to which the student has been admitted. There the student will obtain information about specific degree or certificate requirements that supplement those of the Graduate School.

The student will consult the "Schedule of Classes" and will develop an individual program of study and research in consultation with a graduate faculty adviser.

Students admitted to Advanced Special Status may seek advice from the Office of the Dean for Graduate Studies and Research or from appropriate faculty members.

The Associate Dean for Graduate Student Affairs is the individual to whom requests or petitions for exceptions or waivers of regulations or graduate degree requirements should be addressed and to whom appeals of decisions of departmental or program faculty or administrators should be directed.

Course Numbering System

Courses are designated as follows:

000-099 Non-credit courses.

100-199 primarily first-year courses.

200-299 primarily sophomore courses.

300-399 Junior and senior courses not acceptable for credit toward graduate degrees.

400-499 Junior and senior courses acceptable for credit toward some graduate degrees.

500-599 professional school courses (Dentistry, Law, Medicine) and post- baccalaureate courses not for graduate degree credit.

600-898 Courses restricted to graduate students.

799 Master's thesis credit.

899 Doctoral dissertation credit.

The first character of the numeric position determines the level of the course and the last two digits are used for course identification. Courses ending with an 8 or 9 are courses that are repeatable for credit. All non-repeatable courses must end in 0 through 7.

Designation of Full and Part-time Graduate Students

In order to reflect accurately the involvement of graduate students in their programs of study and research and the use of University resources in those programs, the Graduate School uses the graduate unit in making calculations to determine full or part-time student status in the administration of the minimum registration requirements described below and in responding to student requests for certification of full-time student status. The number of graduate units per semester credit hour is calculated in the following manner:

Courses in the series: 000-399 carry 2 units/credit hour.

Courses in the series: 400-499 carry 4 units/credit hour.

Courses in the series: 500-599 carry 5 units/credit hour.

Courses in the series: 600-898 carry 6 units/credit hour.

Research course: 799 carries 12 units/credit hour.

Research course: 899 carries 18 units/credit hour.

To be certified as full-time, a graduate student must be officially registered for a combination of courses equivalent to 48 units per semester. Graduate assistants holding regular appointments are full-time students if they are registered for at least 24 units in addition to the assistantship. Audited courses do not generate graduate units and cannot be used in calculating full- time or part-time status. The University of Maryland may alter this system in the near future.

Minimum Registration Requirements

All graduate students, masters and doctoral, making any demand upon the academic or support services of the University, whether taking courses, using University libraries, laboratories, computer facilities, office space or housing, consulting with faculty advisers, taking comprehensive or final oral examinations, or filing a diploma application, must register for the number of graduate units that will, in the faculty adviser's judgment, accurately reflect the student's involvement in graduate study and use of University resources. In no case will registration be for less than one credit.

Minimum Registration Requirements for Doctoral Candidates

Doctoral students who have been advanced to candidacy must register each semester, except summer sessions, until the degree is awarded.

Dissertation Research

Those who have not completed the required semester credit hours of Dissertation Research (899) must register for a minimum of one credit of research each semester. (See the following sections for specific doctoral degree registration requirements.) Doctoral candidates whose demands upon the University are greater than that represented by this minimum registration will be expected to register for the number of units that reflects their use of University resources.

Continuous Registration

Doctoral candidates who have completed the required minimum of credit hours of Dissertation Research (899) and are making no use of University resources must meet a Continuous Registration requirement during each semester, except for summer sessions, until the degree is awarded. This requirement is met by submitting the Continuous Registration Form and paying the $10.00 Continuous Registration fee directly to the Graduate School either in person or by mail. Forms and fees must be received before the end of the eighth week of classes during the fall and spring semesters. Continuous Registration forms may be obtained from the Graduate School, Room 2117, Lee Building, University of Maryland, College Park, MD 20742.

Failure to comply with the requirement of maintaining Continuous Registration will be taken as evidence that the student has terminated the doctoral program, and admitted status to the Graduate School will be terminated. A new application for admission,

with the consequent reevaluation of the student's performance, will be required of a student who wishes to resume a graduate program but whose admission has been terminated under this regulation.

Partial Credit Course Registration for Handicapped Students

The Graduate School recognizes that students with documented physical handicaps may derive considerable educational benefit from courses that include laboratories or other non-classroom activities in which the student is prevented from participating because of the handicap. Therefore, it is the Graduate School's policy to allow handicapped students to enroll in such courses, complete only those parts of the course that their physical capabilities permit, and receive credit for the course proportionate to their levels of participation.

Physically handicapped graduate students who wish to enroll in such courses but participate only in certain aspects of them should consult the Associate Dean for Student Affairs in the Graduate School. The Dean will assist the student in making the necessary arrangements with the department offering the course, the department supervising the student's graduate program and the Registration Office. The final agreement as to the student's level of participation and the amount of credit to be awarded will be specified in an agreement to be drawn up by the Graduate School and signed by all parties concerned.

The Inter-Campus Student

A student admitted to the Graduate School on any campus of the University of Maryland is eligible to take courses on any other campus of the University of Maryland with the approval of the academic adviser and the graduate deans on the home and host campuses. Credits earned on a host campus are considered resident credit at the home campus and may meet all degree requirements with adviser approval. Transcripts of courses taken at another campus will be maintained on the home campus and fees will be paid to the home campus. Forms for registration as an inter-campus student may be obtained from the Graduate School offices on any campus of the University.

Registration Through the Washington Consortium Arrangement

The University of Maryland at College Park is a member of the Consortium of Universities of the Washington Metropolitan Area. Other institutions currently associated with the consortium include American University, The Catholic University of America, the University of the District of Columbia, Gallaudet College, George Mason University, Georgetown University, George Washington University, Howard University, Marymount College, Mount Vernon College and Trinity College. Students enrolled in these institutions are able to attend certain classes at the other campuses and have the credit considered "residence" credits at their own institutions. The consortium permits both undergraduate and graduate students to participate in programs such as the Research Fellows Program and the National Institute for Citizen Education in the Law. The policies governing registration through the Consortium Arrangement are listed below.

UMCP Graduate Students

1. UMCP degree-seeking graduate students may take courses at other consortium schools, which are to be treated as UMCP residence credits with the approval of the Director of Graduate Studies of the degree program in which they are enrolled.

2. No more than 25 percent of the course credits required for the UMCP graduate degree may be taken at other consortium schools through the consortium arrangement. Practica, internships, workshops and similar experiential learning courses cannot be taken at other consortium schools.
3. Significant factors to be considered by the Director of Graduate Studies may include but are not limited to:
   a. Unavailability of a similar or comparable course at UMCP within a reasonable time frame. Mere convenience is not adequate justification.
   b. Possible enhancement of the student's overall program in a way not possible at UMCP, as by the presence of unique faculty or the availability of a course not offered at UMCP.
   c. The level and content of the course, including the nature of prerequisite coursework.

Visiting Students

1. Students from other consortium schools may register for UMCP courses on a space-available basis beginning with the first day of classes.
2. Courses for majors in departments or colleges at UMCP that have selective admission programs will not normally be available to students from other consortium schools.
3. Students from other consortium schools are expected to meet all prerequisites for UMCP courses for which they wish to enroll.
4. Students from other consortium schools will not normally be permitted to register for practica, workshops, internships and other experiential courses at UMCP.
5. Students from other consortium schools who have previously applied for admission to a UMCP graduate degree program and have been denied admission will be permitted to register for graduate courses in that program only with the specific approval of the Director of Graduate Studies of the program.
6. Students from other consortium schools who have been dismissed from UMCP for disciplinary or financial reasons will not be permitted to enroll in courses at UMCP under the consortium arrangement.

Graduate Credit for Senior Undergraduates

A senior in the final semester at UMCP who is within seven credit hours of completing the requirements for an undergraduate degree may register for courses with the appproval of the undergraduate dean, the department or program offering the course and the Graduate School. Normally, a 3.0 grade point average for all courses is required for students seeking to exercise this option. Courses elected through this program may later be counted for graduate credit toward an advanced degree at the University if the student is offered admission to the Graduate School. The total of undergraduate and graduate courses must not exceed 15 credits for the semester. Excess credits in the senior year cannot be used for graduate credit unless proper prearrangement is made. Seniors who wish to register for graduate credit can receive information about

the procedure from the Graduate School, Office of the Associate Dean for Student Affairs, 2125 Lee Building.

Undergraduate Credit for Graduate Level Courses

Subject to requirements determined by the graduate faculty members of the department or program offering the course, undergraduate students may register for graduate level courses, i.e., those numbered from 600 to 898, with the exception of 799 and 899, for undergraduate credit.

A student who seeks to use this option will normally be in the senior year, have earned an accumulated grade point average of 3.0, have successfully completed the prerequisite and correlative courses with a grade of "B" or better, and be a major in the appropriate or a closely related department. The student will be required to obtain prior approval from the department offering the course.

Enrollment in a graduate level course does not in any way imply subsequent departmental or Graduate School approval for admission into a graduate program, nor may the course be used as credit for a graduate degree at the University of Maryland.

Combined Bachelor's/Master's Programs

A combined bachelor's/master's program may be developed for the individual student. A combined degree program should be an integrated learning experience for the student, not simply the completion of a required number of undergraduate and graduate credits. It is available only to students whose academic performance is exceptional, i.e., a stipulated grade point average and faculty evaluations and recommendations. The program must be approved by the undergraduate dean, the department or program offering the undergraduate major, the department or program offering the graduate program and the Graduate School. Normally, no more than nine credits of courses taken at the advanced level (600- level courses and above) may be applied to both degree programs. No more than one master's degree may be earned through a combined bachelor's/master's degree program. See your undergraduate adviser for more details.

Credit by Examination

A graduate student may obtain graduate credit by examination in courses at the 400 level previously identified by the appropriate department or program. In the judgment of the Graduate Council, credit by examination is not generally available for courses at the 600, 700, or 800 levels because courses at these levels require a continuing interaction between faculty and students to achieve the educational goals of advanced study.

Students may receive credit by examination only for courses for which they are otherwise eligible to receive graduate credit. The department or program in which the student is enrolled may establish a limit on the number of credits that may be earned in this manner. Graduate students seeking credit by examination must obtain the consent of their adviser and of the instructor currently responsible for the course. Once the student begins the examination, the grade earned will be recorded.

The Graduate School maintains a list of courses for which examinations are available or will be prepared. The fee for credit by examination is $30.00 per course regardless of the number of credits or units to be earned.

Transfer of Credit

A maximum of six semester hours of graduate level course credits earned at regionally accredited institutions prior to or after matriculation in the Graduate School may be applied toward master's degrees at the University of Maryland. Due to academic and procedural differences between foreign and U.S. regionally accredited institutions, credit from foreign universities is not acceptable for transfer. There is no need for transfer of credit at the doctoral level. All graduate study credits offered as transfer credit must meet the following criteria:

1. They must have received graduate credit for courses taken at the other institution.
2. They must not have been used to meet the requirements for any degree previously earned.
3. They must have been elected within the time limit framework of the student's program here.
4. The department or program to which the student has been admitted at Maryland must certify the courses are appropriate to the degree program the student is pursuing at Maryland.
5. The student must have earned a "B" or better in the courses offered for transfer credit, and have a "B" or better average on all the graduate coursework taken at the institution from which the transfer is requested.
6. Transfer work normally satisfies only the 400-level requirements for the master's degree and does not apply to the upper-level requirement.

A student seeking acceptance of transfer credit is advised to submit the necessary transcripts and certification of department or program approval to the Graduate School as promptly as possible for its review and decision. It should be noted that graduate departments and programs may impose more stringent requirements and time limitations concerning the transfer of credits. In such cases the Graduate School must be notified accordingly.

Criteria that Courses Must Meet to be Accepted for Graduate Credit

Any courses, workshops or seminars planned to take place in a span of time less than a normal academic semester or summer session and offering graduate credit to the participants must meet the following criteria:

1. There must be 15 "contact hours" per graduate credit.
   a. Lectures: one contact hour per 50 minutes lecture.
   b. Non-lecture contact (laboratory, workshops, discussion and problem-working sessions, etc.): one contact hour per two or three-hour session.
2. No more than three "contact hours" per day will be permitted. (Three "contact hours" are equivalent to 0.2 credits)
3. Credit may be accumulated at the rate of no more than one credit per week.

Statement on UMCP Policy on Non-participation by Students in Class Exercises that Involve Animals

Students who are concerned about the use of animals in teaching have the responsibility to contact the instructor prior to course enrollment to determine if animals are

to be used in the course, whether class exercises involving animals are optional or required and what alternatives, if any, are available. If no alternatives are available, the refusal to participate in required activities involving animals may result in a failing grade in the course.

The University of Maryland at College Park affirms the right of the faculty to determine course content and curriculum requirements. The University, however, also encourages faculty to consider offering alternatives to the use of animals in their courses. In each course, the instructor determines whether the use of animals in the classroom exercises will be a course requirement or optional activity. The following departments currently have courses that may require animals to be used in class activities: Animal Sciences, Human Nutrition and Food Science, Microbiology, Poultry Science, Psychology, Veterinary Medicine and Zoology. For UMCP's policy statement on animal use and care, see the catalog's Appendices section.

Course and Credit Changes

A graduate student may drop a course, add a course, change between audit and credit status, change the number of credits for a course within the listed range, cancel registration or withdraw from the University by obtaining the necessary approvals and observing the published deadlines and procedures. The deadlines are published each term in the Schedule of Classes; the procedures governing each of these transactions are listed below.

Procedures for Schedule Adjustment

A graduate student may transact the following schedule adjustments through the tenth week of classes in a term by submitting a Schedule Adjustment Form to the Registrations Office, Mitchell Building: add a course; drop a course; change grading option; and change credit level. There is currently a $2.00 charge for each drop and add form processed after the tenth day of class. There is no refund of tuition and fees for drops processed after the fifth class day (see "Schedule of Classes" for further details).

After the tenth day of classes, all graduate students are required to obtain Departmental and instructor authorization to be stamped or written on the add slip. Approved requests must be promptly delivered to the Registrar's Office, Mitchell Building.

Procedures for Late Registration

Students registering after the established registration period may need an appointment to register. Call the Office of Registrations and Records for information. For current registration procedures consult the Schedule of Classes. Students who register after the established registration period (i.e., beginning with the schedule adjustment period) will be assessed a $20 late registration fee.

Procedures for Credit Level Change and Change of Grading Option

Students who wish to change their grading option or credit level in a course may do so without special approval until the tenth class day each term. After the tenth class day, departmental authorization is required until the end of the tenth week. No credit level changes or grading options are permitted after the tenth week of classes.

1. Exceptions to this deadline require the written approval of the instructor and the approval of the Graduate School.

2. The departmental stamp must be placed on the change of grading option/ credit level form.
3. Approved forms should be submitted to the Registrar's Office, Mitchell Building.

Procedures for Withdrawal from Classes

The term withdrawal means termination of enrollment for a given term. The date of the withdrawal is indicated on a graduate student's academic record. To withdraw from a term on or before the last day of classes a graduate student must notify the Records Office, 1101 Mitchell Building, in writing or in person. Withdrawal becomes effective on the date notification is received in the Records Office. Additional information concerning withdrawal from classes can be found in the "Schedule of Classes".

If the time limits in a master's or pre-candidate doctoral student's program have not lapsed (5 years to obtain a master's degree and 5 years to reach doctoral candidacy,) a graduate student is eligible to enroll without readmission. In such cases the student should contact the department about registration dates and procedures. Doctoral candidates typically do not withdraw. If a candidate believes he/she must withdraw, he/ she must contact the Office of the Associate Dean for Student Affairs.

Resignation From the University

A graduate student wishing to resign from the University (i.e., terminate his/her association with the University) may do so by submitting a letter to the Graduate School indicating the reasons for the resignation. The Graduate School will cancel the student's admitted status. If the student is registered for classes at the time of his/her resignation, the Office of Records and Registrations will be requested to withdraw the student effective the date of the resignation.

A graduate student seeking to return to the University of Maryland must reapply for admission and is subject to all departmental and Graduate School requirements. He or she may be required to repeat previously elected courses.

Procedure for Cancelling Registration for a Term

To cancel a registration after the stated deadlines for a given term, a graduate student must provide a written explanation, which has been endorsed by the graduate director of his or her program to the Associate Dean for Student Affairs. If appropriate, the request will be processed and, if fees are involved, the necessary adjustments made. Please note that the cancellation of one's classes during the course of a given term is not meant to be used as a means of avoiding poor grades.

Grades for Graduate Students

A minimum grade point average of 3.0 for all graduate level courses taken is required in order to be in good academic standing and for graduation with a graduate degree. Graduate students are required to meet all departmental and program rules and regulations. Departments and programs may stipulate requirements more stringent than those minimally expected by the Graduate School.

Academic Discipline Policy

Each graduate student is required to maintain a 3.0 grade point average for all graduate courses elected toward the degree program in which he or she is enrolled.

A student whose cumulative grade point average falls below a "B" (3.0) upon or after the completion of nine credit hours of graduate level courses will be automatically placed on academic probation by the Graduate School for the following full semester.

A student whose cumulative grade point average falls below a "B" (3.0) for a second and successive semester of enrollment for courses may, upon the recommendation of her or his graduate chair and with the consent of the Graduate School, be granted a final opportunity to correct the scholastic and/or academic deficiency in the next semester of enrollment for courses.

A student whose cumulative grade point average falls below a "B" (3.0) average for three consecutive semesters of enrollment will not be permitted to re-enroll and will be required to withdraw from the University.

Both the graduate student and the Graduate Director of each department or program will be notified whenever a graduate student is placed on academic probation. If a graduate student is placed on probation for a second consecutive semester, both the graduate student and the student's Graduate Director will be informed that the student may not continue beyond that semester unless the academic department or program presents compelling reasons for continuance. The request for continuance must be approved by the Graduate School.

In addition to the minimum grade point average requirements, graduate departments and programs may require graduate students to maintain certain performance minima in their programs of study, and in all or in particular courses. A student who fails to make satisfactory progress in meeting some or all programmatic requirements, or who fails to demonstrate the ability to succeed in his or her course of studies or research, may be required to withdraw from the University. Determinations concerning such matters occur at the departmental level.

Grading Systems

The Conventional A through F grading system is used in graduate level courses.

A "Satisfactory or Failure" (S-F) grading system may be used for certain types of graduate study at the discretion of the department or program. These include courses which require independent field work, special projects or independent study. Departmental seminars, workshops and departmental courses in instructional methods may also be appropriate for the S-F grading system.

The "Pass-Fail" grading system is a grading option for undergraduates. However, a Department or program may give permission in certain cases for a graduate student to use the Pass-Fail option for any 100-300 level courses that a student takes. Graduate credit may not be earned for these courses. Either the A-F or the S-F grading system may be used in thesis and dissertation research, and courses labeled "Independent Study" or "Special Problems."

Only one grading system will be used for a single course in a particular semester. The grading system will be designated by the department or program offering the course.

Computation of Grade Point Average

The A is calculated at 4 quality points, B at 3 quality points and C at 2 quality points. The grades of D, F and I receive no quality points. After a student is matriculated as

a graduate student, all courses taken that are numbered 400 and above (except 500-level courses, those numbered 799 or 899, and those graded with an S) will be used in the calculation of the grade point average. A student may repeat any course in an effort to earn a better grade. Whether higher or lower, the latter grade will be used in computing the grade point average. Grades for graduate students remain as part of the student's permanent record and may be changed only by the original instructor on certification that an actual mistake was made in determining or recording the grade. The change must be approved by the department chair and the Dean for Graduate Studies and Research.

No course taken after August 23, 1974, will be considered "not applicable" for the purpose of computing the grade point average of a graduate student. No graduate credit transferred from another institution will be included in the calculation of the grade point average.

The Academic Record (Transcript)

A graduate student's academic record (transcript) is intended to serve as a complete history of the student's academic progress at the University of Maryland. As such, it cannot be altered except in conformance with stated Graduate School policies governing change of election. Under no circumstances will the academic records be altered because of dissatisfaction with a grade or other academic accomplishment.

Degree Requirements

Graduate School Requirements Applicable to all Master's Degrees.

Programs

The entire course of study undertaken for any master's degree must constitute a unified, coherent program that is approved by the student's adviser and graduate director and meets Graduate School requirements.

A minimum of thirty semester hours in courses acceptable for credit towards a graduate degree is required (some degree programs require more than 30 credits); in certain cases, six of the 30 semester hours must be thesis research credits. The graduate program must include at least 12 hours of coursework at the 600 level or higher. If the student is inadequately prepared for the required graduate courses, additional courses may be required, which may not be considered as part of the student's graduate program. Credits to be applied to a student's program for a master's degree cannot have been used to satisfy any other previously earned degrees.

Grade-Point Average

The student seeking any master's degree must maintain an average grade of "B" (3.0) in all courses taken for graduate credit.

Time Limitation

All requirements for the master's degree must be completed within a five-year period. This time limit applies to any transfer work from other institutions to be included in a student's program.

Additional Requirements

In addition to the above requirements, special departmental or collegiate requirements may be imposed, especially for degrees that are offered only in one department, college or division. For these special requirements, consult the descriptions which appear under the departmental or collegiate listing in this catalog or the special publications that can be obtained from the department or college.

Graduate School Requirements for the Degrees of Master of Arts and Master of Science

THESIS OPTION

Research Assurances

At the University of Maryland at College Park, all research, including thesis and dissertation research, must be conducted in accordance with federal guidelines for the use of animals, the use of human subjects and the use of materials that may pose biological or chemical hazards. All animal use protocols must be approved by the Animal Care and Use Committee. Research involving human subjects must be approved by the departmental human subjects review board and/or the Institutional Review Board. Any research involving hazardous materials, either biological or chemical, or recombinant RNA/DNA research must have approval from the campus Department of Environmental Safety.

Course Requirements

A minimum of 30 semester hours including six hours of thesis research credit (799) is required for the degrees of Master of Arts and Master of Science. Of the 24 hours required in graduate courses, no less than 12 must be earned in the major subject. No less than one-half of the total required course credits for the degree, or a minimum of twelve, must be selected from courses number 600 or above.

Thesis Requirement

A thesis must be submitted for the Master of Arts and Master of Science degrees except for those programs in which a non-thesis option has been approved by the Dean in conformity with the policy of the Graduate Council. Approval of the thesis is the responsibility of an examining committee appointed by the Dean on the recommendation of the student's adviser. The adviser is the chairperson of the committee, and the remaining members of the committee are members of the graduate faculty who are familiar with the student's program of study. The chairperson and the candidate are informed of the membership of the examining committee by the Dean.

Directions for the preparation and submission of theses will be found in the ***Theses Manual***, which may be obtained from Room 2117, Lee Building.

Oral Examination

A final oral examination on the thesis shall be held when the student has completed the thesis to the satisfaction of the student's adviser, providing all other requirements for the degree have been completed and a 3.0 grade point average computed in accordance with the regulations described under "Grades for Graduate Students" has been earned.

The examining committee, composed of a minimum of three members, conducts the oral examination (an additional comprehensive written examination may be required at the option of the department or program). The chairperson of the examining committee selects the time and place for the examination and notifies other members of the committee and the candidate. Members of the committee must be given a minimum of seven school days in which to read the thesis. The duration of the examination is normally about an hour, but it may be longer if necessary to insure an adequate examination.

The decision to accept the examination as satisfactory must be unanimous. Students may present themselves for examination only twice. The report of the committee, signed by each member, must be submitted to the Dean for Graduate Studies and Research no later than the appropriate date listed in the "Important Dates for Advisers and Students" if the student is to receive a diploma at the Commencement ceremony for the semester in which the examination is held.

NON-THESIS OPTION

The requirements for Master of Arts and Master of Science degrees without thesis vary slightly among departments and programs in which this option is available. Standards for admission are, however, identical with those for admission to any other master's program. The quality of the work expected of the student is also identical to that expected in the thesis programs.

The general requirements for those on the non-thesis program are a minimum of 30 semester credit hours in courses approved for graduate credit with a minimum average grade of B in all coursework taken; a minimum of 18 semester credit hours in courses numbered 600 or above; the submission of one or more scholarly papers; and successful completion of a comprehensive final examination, a portion of which must be written.

A student following a non-thesis master's program will be expected to meet the same deadlines for application for a diploma and for final examination reports established for all other degree programs.

For information on programs that offer the non-thesis option, see the list of Graduate programs in the ***Catalog***.

Requirements for the Degree of Master of Education

Nearly all departments in Education offer the Master of Education (M.Ed.) degree with the following requirements:

1. A minimum of 30 semester hours in coursework with a B grade average. Grades for courses not a part of the program but taken in graduate status will be computed in the average.
2. A minimum of 15 hours in courses numbered 600-800 with the remainder at least in the 400 series. Some departments require courses in departments other than Education.
3. A comprehensive written examination taken at the end of coursework.
4. EDMS 645.
5. EDMS 646 or MUED 690 and one seminar paper; or two seminar papers.

For further details, see "Graduate Studies in the College of Education" issued by the College of Education and descriptions of departmental programs.

Requirements Applicable to other Master's Degrees

The particular requirements for the degrees of Master of Architecture, Master of Business Administration, Master of Library Science, Master of Music, Master of Fine Arts, Master of Public Policy, Master of Public Management and Master of Applied Anthropology are given under the individual graduate program entries in those fields.

Graduate School Requirements Applicable to all Doctoral Degrees

Credit Requirements

The Graduate School requires that every student seeking the doctoral degree register for a minimum of 12 research credits, but the number of research and other credit hours required in the program varies with the degree and program in question.

Admission to Candidacy

Preliminary examinations, or such other substantial tests as the departments may elect, are frequently prerequisite for admission to candidacy.

A student must be admitted to candidacy for the doctorate within five years after admission to the doctoral program and at least one academic year before the date on which the degree will be conferred.

It is the responsibility of the student to submit an application for admission to candidacy when all the requirements for candidacy have been fulfilled. Applications for admission to candidacy are made in duplicate by the student and submitted to the major department for further action and transmission to the Graduate School. Application forms may be obtained at the Graduate School Records Office.

Time Limitation

The student must complete the entire program for the degree, including the dissertation and final examination, during a four-year period after admission to candidacy. Extensions of time are granted only under the most unusual circumstances. If students fail to complete all requirements within the time allotted, they must submit another application for admission to the Graduate School and, if readmitted, another application for Advancement to Candidacy, after satisfying the usual program prerequisites prior to Advancement to Candidacy.

Dissertation

A dissertation or its equivalent is required of all candidates for a doctoral degree. The topic of the dissertation must be approved by the department or program committee.

During the preparation of the dissertation, all candidates for any doctoral degree must register for the prescribed number of semester hours of Doctoral Dissertation Research (899) at the University of Maryland.

Directions for the preparation and submission of dissertations will be found in the ***Theses Manual***, which may be obtained from the Graduate School Records Office.

Additional Requirements

In addition to the above requirements, special departmental or collegiate requirements may be imposed, especially for those degrees that are offered in only one de-

partment or college. For these special requirements, consult the descriptions that appear under the departmental or collegiate listing in this catalog or the special publications that can be obtained from the department, college or division.

Graduate School Requirements for the Degree of Doctor of Philosophy

The Doctor of Philosophy Degree is granted only upon sufficient evidence of high attainment in scholarship and the ability to engage in independent research. It is not awarded for the completion of course and seminar requirements no matter how successfully completed.

Foreign Language Requirement

A number of departments have a foreign language requirement for the Doctor of Philosophy degree. The student should inquire in the department about this requirement. Students must satisfy the departmental or program requirement before they can be admitted to candidacy for the doctorate.

Program

There is no Graduate School requirement stipulating a specific number of course credits in either a major or a minor subject. It is the policy of the Graduate School to encourage the development of individual programs for each student who seeks the Ph.D. To that end, the academic departments and interdisciplinary programs have been directed to determine major and minor requirements, levels or sequences of required courses and similar requirements for submission to the Graduate Council for approval.

Admission to Candidacy

See requirements for all doctoral degrees.

Dissertation

The ability to do independent research must be demonstrated by an original dissertation on a topic approved by the department or program.

During the preparation of the dissertation, all candidates for the Doctor of Philosophy degree must register for a minimum of 12 semester hours of doctoral research (899) at the University of Maryland.

Constitution of Dissertation Committee

1. A dissertation committee must consist of a minimum of five members, at least three of whom must be regular members of the University of Maryland at College Park Graduate Faculty. Additional committee members may be required or invited to serve at departmental discretion.
2. Each dissertation committee will have a chairperson, who must be a regular member of the Graduate Faculty. Dissertation committees may be co-chaired upon written recommendation of the department graduate director or chair and the approval of the Dean of Graduate Studies and Research. At least one of the co-chairs must be a regular member of the Graduate Faculty.

3. Each committee shall have appointed to it a representative of the Dean for Graduate Studies and Research. This person, who is recommended by the student's home department, must be a regular member of the Graduate Faculty at the University of Maryland at College Park and must be from a department other than the student's home department. In cases where a student is in an interdisciplinary department or program, the Dean's Representative must be from a program outside the departments and programs involved in the interdisciplinary endeavors.
4. Individuals from outside the University system may serve on dissertation committees provided that their credentials warrant this service and upon the written request of and justification by the department involved, including the individual's curriculum vitae. However, these individuals must be in addition to the minimum required number of regular members of the College Park Graduate Faculty.
5. Emeriti and retired professors may serve on dissertation committees provided they are members of the Graduate Faculty.
6. Graduate Faculty who terminate employment at UMCP may be regarded for dissertation committee service purposes as members of the Graduate Faculty for a 12-month period following their termination. During that time they may chair individual dissertations and theses and work with students as necessary. After that time, they may no longer serve as chairs of dissertations, although they may be placed in the status of co-chair. After they leave UMCP, faculty may not serve as Dean's Representative.

The Dissertation Committee and the Conduct of the Dissertation Defense

Each doctoral candidate is required to orally defend his or her doctoral dissertation as a requirement in partial fulfillment of the doctoral degree. The final oral defense of the dissertation is conducted by a committee of the Graduate Faculty appointed by the Dean for Graduate Studies and Research upon the advice of the candidate's dissertation adviser and department graduate director.

Oral defenses must be attended by all members of the officially established doctoral examining committee as approved by the Dean for Graduate Studies and Research. Should a last-minute change in the constitution of the committee be required, the change must be sanctioned by the Dean for Graduate Studies and Research in consultation with the graduate director of the student's home department and the student's dissertation chair.

Notice of doctoral defenses must be published in the student's home department at least five days before the scheduled event. The members of the examining committee should normally receive the dissertation at least two weeks before the scheduled defense. All doctoral defenses must be open to UMCP Graduate Faculty and any other interested parties whom the chair of the dissertation committee, in consultation with the Graduate Director of the department, believe to be appropriate. Departments may wish to routinely open dissertation defenses to a broader audience. In such cases, departmental policies must be established, recorded and made available to all doctoral students.

Oral defenses of dissertations must be held in University facilities that are readily accessible to all members of the committee and others attending the defense.

Two or more negative votes constitute a failure of the candidate to meet the dissertation requirement. In cases of failure, it is required that the examining committee specify in detail and in writing to the department graduate director, the Dean for Graduate Studies and Research and the student the exact nature of the deficiencies in the dissertation and/or the oral performance that led to failure. A second defense is permitted, which results in termination of the student's admitted status if it is failed.

Inclusion of Previously Published Materials in a Thesis or Dissertation

1. A graduate student may, upon the recommendation of the dissertation director, and with the endorsement of home department graduate directors or chairs, include his or her own published works as part of the final dissertation. Appropriate citations within the dissertation including where the work was previously published are required. All such materials must be produced in standard dissertation format.
2. It is recognized that a graduate student may co-author work with faculty and colleagues that should be included in a dissertation. In such an event, a letter should be sent to the Dean of Graduate Studies and Research certifying that the student's examining committee has determined that the student made a substantial contribution to that work. This letter should also note that inclusion of the work has the approval of the dissertation adviser and the department chair or graduate director. The format of such inclusions must conform to be standard dissertation format. A forward to the dissertation, as approved by the Dissertation Committee, must state that the student made the substantial contributions to the relevant aspects of the jointly authored work included in the dissertation.

Requirements for the Degree of Doctor of Education

The requirements for the Doctor of Education (Ed.D) degree are for the most part the same as those for the Doctor of Philosophy degree in the College of Education. The Ed.D. requires a minimum of six semester hours of dissertation credit while the Ph.D. requires a minimum of 12 semester hours of dissertation credit. Consult the Graduate Studies Office in the College of Education and the individual department for additional details.

Requirements for other Doctoral Degrees

The particular requirements for the degrees of Doctor of Musical Arts are given under the corresponding program description.

Time Extensions Governing Degrees

Students who fail to complete all requirements by the prescribed deadlines may petition their departments in order to seek up to a one-year extension of time in which to complete the outstanding requirements. This extension may be granted by the department, which must then notify the Graduate School in writing of its decision. The Graduate School will confirm this decision in writing to the student and adjust the computer database accordingly. Students who fail to complete all requirements for the

degree following the granting of a time extension by the department must seek any additional extension by petitioning the department. If the department supports the request, it must forward the request to the Graduate School for review. In such cases, the Administrator of Graduate Admissions and Records evaluates the request in light of the written explanation provided and may grant up to one additional year's extension. The Graduate School decision will be communicated in writing to each petitioner and a copy will be sent to the student's home department.

Petition for Waiver or Partial Waiver of a Regulation

All policies of the Graduate School have been formulated by the Graduate Council, the governing body of the Graduate School, with the goal of ensuring academic quality. These policies must be equitably and uniformly enforced for all graduate students. Nevertheless, circumstances occasionally occur that warrant individual consideration. Therefore, if a graduate student believes there are compelling reasons for a specific regulation to be waived or modified, the student should submit a written petition to the Graduate School, Room 2125, Lee Building, explaining the facts and issues that bear on the case. In all instances, the petitions must be reviewed by the departmental graduate director or chair and, if the petition involves a course, by the course instructor. If both of these people recommend approval and so state in writing, it is then forwarded to the Graduate School for final review.

Commencement

Applications for the diploma must be filed with the Office of Admissions and Registrations within the first three weeks of the semester in which the candidate expects to obtain a degree, except during summer session. During the summer session, the application must be filed during the first week of the second summer session. Exact dates are noted for each semester and the summer sessions in "Important Dates for Advisers and Students." Failure to meet specific deadlines may result in a delay of one or more semesters before graduation.

If, for any reason, students do not graduate at the end of the semester in which they have applied for the diploma, they must re-apply for it in the semester in which they expect to graduate.

Academic costume is required of all candidates at commencement exercises. Those who so desire may purchase or rent caps and gowns at the UMCP student supply store. Orders must be filed eight weeks before the date of commencement but may be cancelled later if students find themselves unable to complete the requirements for the degree.

Resources

Location

Faculty and students at the University of Maryland enjoy the best of all possible worlds. Situated on 1,300 acres in Prince George's County, College Park is part of the larger metropolitan area of Washington, D.C., which is rapidly becoming the nation's capital in cultural and intellectual activity as well as political power. The Kennedy Center for the Performing Arts, the Filene Center and the many fine area theaters regularly present performances by the world's most exciting and renowned artists. The

Smithsonian Museums and the National Gallery of Art, among others, sponsor outstanding collections and special exhibits that attract national attention. In addition to cultural activities, the nation's capital provides interested students the opportunity to observe first hand the work of federal institutions; to sit in the galleries of Congress; to watch the Supreme Court in session; and to attend public Congressional hearings. The possibilities for personal enrichment offered in this exciting cosmopolitan area are indeed enormous.

Outside the metropolitan area and just minutes from the campus, the Maryland countryside is pleasantly rural. Maryland offers a great variety of recreational and leisure activities in its many fine national and state parks, from the Catoctin Mountains in Western Maryland to the Assateague Island National Seashore on the Atlantic-bound Eastern Shore, all within a pleasant drive from the campus. Historic Annapolis, the state capital, is only a short drive away, and the city of Baltimore, with its rich variety of ethnic heritages, its cultural and educational institutions and its impressive urban transformation is only thirty miles from College Park.

Special Research Resources

The College Park Campus is in the midst of one of the greatest concentrations of research facilities and intellectual talent in the nation, if not in the world. Libraries and laboratories serving virtually every academic discipline are within easy commuting distance. There is a steady and growing exchange of ideas, information, technical skills and scholars between the University and these centers. The libraries and facilities of many of these centers are open to qualified graduate students. The resources of many more are available by special arrangement.

In the humanities, the Library of Congress and the Folger Shakespeare Library, with its extensive collection of rare manuscripts, are among the world's most outstanding research libraries. In addition, Dumbarton Oaks; the National Archives; the Smithsonian Institution; the World Bank; the National Library of Medicine; the National Agricultural Library; the Enoch Pratt Free Library of Baltimore; the libraries of the Federal Departments of Labor; Commerce; Interior; Health and Human Services; Housing and Urban Development; Transportation and approximately 500 other specialized libraries are all within a few minutes drive of the College Park campus. The campus will soon be the site for Archives II, the largest archives in the world with the most complete set of records and documents about this nation's history. The facility is scheduled to be open in 1993. These resources make the University of Maryland at College Park one of the most attractive in the nation for scholars of all disciplines.

The proximity of the Beltsville Agricultural Research Center of the United States Department of Agriculture has stimulated the development of both laboratories and opportunities for field research in the agricultural and life sciences. The National Institutes of Health offer unparalleled opportunities for collaboration in biomedical and behavior research. Opportunities are also available for collaborative graduate study programs with other major government laboratories, such as the National Institute of Science and Technology, the Naval Research Laboratory, and the U.S. Geological Survey. The long-standing involvement of the state of Maryland in the development of the commercial and recreational resources of the Chesapeake Bay has resulted in the establishment of outstanding research facilities for the study of marine science at the University of Maryland Center for Environmental and Estuarine Studies, with

research facilities at Horn Point near Cambridge, at Crisfield and at Solomons Island, Maryland.

Campus facilities are also excellent for research in every discipline. Work in the behavioral sciences, particularly in learning, is centered in laboratories equipped for fully automated research on rats, pigeons and monkeys.

Exceptional research facilities in the physical sciences include two small Van de Graaff accelerators; an assortment of computers, including a pDp 11/45, a UNIVAC 1108 and a UNIVAC 1100/41; a 250 KW training nuclear reactor,; a full-scale low velocity wind tunnel; several small hypersonic helium wind tunnels; specialized facilities in the Institute for Physical Science and Technology; a psychopharmacology laboratory; shock tubes; a quiescent plasma device (Q-machine) and a spheromak compact fusion device for plasma research; and rotating tanks for laboratory studies of meteorological phenomena.

Students also have access to research farms, greenhouses and even laboratory-equipped vessels for research in the Chesapeake Bay. The University also owns and operates one of the world's largest and most sophisticated long-wavelength radio telescopes as part of a three-university consortium known as the Berkeley-Illinois-Maryland Array (BIMA) located at Hat Creek in Northern California.

Special Opportunities for Artists

Advanced work in the creative and performing arts at College Park is concentrated in the Tawes Fine Arts Building and the recently completed Art-Sociology Building. Creative work is greatly stimulated by the close interaction that has developed between the students and faculty of the University and the artists and scholars at the National Gallery, the Corcoran Gallery, the Hirshhorn Museum, the Phillips Gallery, the Smithsonian Institution, as well as the musicians of the National Symphony Orchestra, the Baltimore Symphony Orchestra and small musical groups. The Kennedy Center for the Performing Arts and the Filene Center (Wolf Trap Farm Park) have further enhanced the climate for creative artists attending the University.

Outstanding work on campus in theater, dance, radio and television is aided by the proximity of the campus to the National Theater, the Arena Stage, the Morris Mechanic Theater and numerous little theater groups in the Washington and Baltimore area. There is a frequent and steady exchange of ideas and talent between students and faculty at the University with educational and commercial radio and television media, as a consequence of the large professional staffs that are maintained in the Washington area.

Libraries

The libraries on the College Park campus contain nearly two million volumes, and they subscribe to more than 22,000 periodicals and newspapers. Additional collections of research materials are available on microfilm, microfiche, phonograph records, tapes and films.

The Theodore R. McKeldin Library is the largest library on campus and the principal library for graduate use in the humanities, social sciences and life sciences. Special collections include those of Thomas I. Cook in political science; Romeo Mansueti in the biological sciences; Katherine Anne Porter and Djuna Barnes; materials from the Bureau of Social Science Research; the archives of the Baltimore News-American;

Maryland documents; and the files of the Industrial Union of Marine and Shipbuilding Workers of America. The University is also a regional depository of U.S. Government publications, and the Government Documents/Maps Room in McKeldin includes U.S. Government publications, documents of the United Nations, the League of Nations and other international organizations, agricultural experiment station and extension service publications, and maps from the U.S. Army Map Service. The East Asia Collection is the world's largest repository of published and unpublished Japanese-language materials from the Allied Occupation period. The McKeldin collections also include microfilm productions of government documents, rare books, early journals and newspapers.

Graduate students at UMCP are not served by McKeldin alone; the UMCP Libraries system also includes six branch libraries. Although the Hornbake Library's collection is primarily for the undergraduate student, this library does offer ample study space and a 24-hour study room during fall and spring semesters. Hornbake also houses Nonprint Media Services, the central location for audiovisual materials in the library system and the campus, and the Music Library with books, periodicals, music scores and parts and music recordings in both music and dance. The Music Library's special collections include items from the American Bandmasters Association Research Center, the National Association of College Wind and Percussion Instructors Research Center, the International Clarinet Society Research Library and the International Piano Archives at Maryland.

The Engineering and Physical Sciences Library (EPSL) contains materials in physics, engineering, mathematics and geology with other significant collections in computer science, environmental sciences, water resources and aerospace science. EPSL is also a U.S. patent depository and its large Technical Reports Center contains collections from NASA, ERDA, Rand Corporation, and other agencies and organizations.

The Charles E. White Memorial Library is a collection of chemistry, biochemistry and microbiology materials. Materials include books, periodicals, major indexes and comprehensive spectra collections.

Architecture students are served by the Architecture Library with materials on architectural design, theory and history, urban design, landscape architecture and building technology. This library's special collections include rare architecture books dating as far back as the seventeenth century, materials on world expositions from 1857 to 1937, and the collection of the National Trust for Historic Preservation Library.

For art students, the Art Library collects materials in art history, studio art, art education, photography, graphic arts, interior design and textiles. Special collections include art reproductions and art exhibition catalogs.

Research is supported in the UMCP Libraries with a variety of technological tools. An online catalog identifies library materials from the collections of libraries in the University of Maryland system including the UMBC, UMES, UMAB-Law and UMUC campuses. It provides access to this information through public terminals located throughout the library system and through network and telephone connections using terminals in homes or offices. Research is also supported through CARS (Computer Assisted Reference Services) for accessing hundreds of remote bibliographic, textual and numeric databases.

In the McKeldin, Hornbake, White Memorial, and Engineering and Physical Sciences Libraries, library users can run their own computer searches utilizing dial-in service and CD-ROM (Compact Disc-Read Only Memory) for database information in education, social sciences, life sciences, business and patents. Both McKeldin and Hornbake Libraries offer microcomputers for the use of anyone in the UMCP community.

Research is also supported through a variety of user consultation services, including directional assistance, basic reference help and in-depth consultations for complex information problems. Such help may be requested at the reference desk of any of the libraries.

Borrowing library materials is aided by several services in addition to basic circulation assistance. Direct borrowing privileges are available for registered UMCP graduate students at the other University of Maryland campus libraries. Inter-Library loan services are available through McKeldin Library's ILL office to obtain loans or photocopies of materials from other libraries that are not available at UMCP.

Associations, Bureaus, Centers, Institutes and Offices

Acknowledging the importance of an interdisciplinary approach to knowledge, the University maintains organized research units outside the usual department structures. These associations, bureaus, centers and institutes offer valuable opportunities for faculty and students to engage in research and study in specialized areas and in public service activities.

Associations

American Studies Association: Executive Director: John Stephens. The College of Arts and Humanities and its Department of American Studies sponsor the national headquarters of the American Studies Association. ASA plays an active role in international and national academic life and is open to those who are devoted to the interdisciplinary study of the United States. ASA is a constituent member of a number of national scholarship organizations, including the American Council of Learned Societies, the National Humanities Alliance and the National Coordinating Committee for the Promotion of History. ASA also supports and assists programs for teaching American Studies abroad, encourages the exchange of teachers and students and maintains relations with American Studies Associations throughout the world. University of Maryland faculty serve on the managing editorial board of the "American Quarterly," ASA's guide to studies in United States culture, and graduate assistants serve as the ASA's Convention Coordinator, Newsletter Editor and Institutional Research Coordinator.

Bureaus

Bureau of Business and Economic Research: Director: John H. Cumberland. The Bureau of Business and Economic Research conducts economic research in the areas of regional and urban development, environmental and natural resources management, and state and local public finance. projects are funded by the University and by State and Federal Government agencies. Research is conducted by Bureau faculty members, who hold joint appointments with the Department of Economics, and by advanced graduate students working on degree programs.

Bureau of Governmental Research: Director: Allen Schick. Bureau of Governmental Research activities relate primarily to the problems of state and local government in Maryland. The Bureau engages in research and publishes findings with reference to

local, state and national governments and their interrelationships. It undertakes surveys, sponsored programs and grants, and offers its assistance and service to units of government in Maryland. The Bureau furnishes opportunities for qualified students interested in research and career development in state and local administration.

Centers

Center on Aging: Director: Laura Wilson. Established in 1974, the Center on Aging has a university-wide mandate to promote aging-related activities. The Center's goals are to: (1) conduct disciplinary and interdisciplinary aging- related research; (2) encourage departments, schools and colleges to pursue aging-related research and develop gerontologically-oriented courses; (3) provide students with educational programs, field experiences, training opportunities and job placements that will prepare them for careers in aging-related occupations; and (4) conduct training programs, sponsor conferences and provide on and off-campus technical assistance to meet the needs of practitioners who serve older persons. In addition, the Center sponsors a colloquium series on aging-related topics that is open to students and the public, conducts training and conferences for community-level practitioners, and offers the annual Institute for Gerontological Practice for persons involved in direct service activities for the elderly. The Center coordinates the Graduate Gerontology Certificate for students pursuing master's and doctoral degrees in regular University departments as well as for those who return to the campus as advanced special students.

Agriculture Trade Policy Center: Director: Earl Brown. Housed in the Department of Agricultural and Resource Economics, the Center's purpose is to produce cutting edge policy research that will be used to increase the understanding of the complex web of economic and political forces that affect worldwide trade flows of agricultural, fishery and biotechnology food products and services. The Center, which was established in 1990, will support graduate students, visiting scholars and faculty from other campus departments who are interested in collaborating on an important issue in agricultural trade policy. The Center will also support a modest outreach program for policymakers, business executives and policy researchers to facilitate the implementation of the Center's research findings.

Center for Archaeology: Acting Director: Robert J. Rowland, Jr. The Center for Archaeology involves faculty in the departments of Anthropology, Art History, Classics, History and Physics as well as the School of Architecture. The Center seeks to foster interdisciplinary research in archaeology by sponsoring lectures and symposia. Students are also encouraged to participate in the archaeological research being conducted on four different continents by members of the Center.

Center for Architectural Design and Research (CADRE): Director: John W. Hill. Housed in the School of Architecture, CADRE was established in 1978 to permit faculty and students of the School of Architecture to offer services and gain experience in areas not accessible through the University of Maryland's customary channels for funded research. A wide range of planning and design problems, usually small in scale, exists throughout the state in communities and towns that find themselves deteriorating or threatened by uncontrolled expansion. These problems often require capabilities and approaches not usually offered by architectural and engineering firms. Town or country officials and local citizens call upon CADRE to assist in evaluating problems, making recommendations for action and implementing solutions. Examples of past projects

include a master plan proposed on the historic National Colonial Farm; the Hyattsville Main Street revitalization study; the Colmar Manor and Cottage City commercial corridor study; and the Brookville historic study and plan. CADRE is a non-profit corporation, chartered by the State of Maryland.

Architecture and Engineering Performance Information Center (AEPIC): Director: John Loss. A joint center of the School of Architecture and the College of Engineering, AEPIC was founded in 1982 to develop the systems, programs, software and storage networks for the systematic collection, collation, analysis and dissemination of information about the performance (dysfunction) of buildings, civil structures and other constructed facilities.

Architects, engineers, contractors, developers, manufacturers, lawyers, building owners and users, federal and state agencies, insurance underwriters, university and private research organizations and others interested in the objectives of AEPIC can use this computer-based collection of performance information for: (1) planning new projects; (2) reviewing existing structures for rehabilitation or restoration; (3) teaching (case studies); (4) modifying codes and regulations; (5) planning research; (6) preparing professional texts; (7) investigating for dispute resolution; (8) developing new products for the industry; (9) implementing effective quality control measures; (10) improving professional and industry practice; and (11) creating an in-house resource base with lessons learned from project performance.

Center for Automation Research: Director: Dr. Azriel Rosenfeld. The Center for Automation Research, established in 1983, conducts interdisciplinary research in many areas of automation. The Center currently consists of three laboratories: Computer Vision, Human/Computer Interaction, and Robotics. Some of the principal areas of interest of these laboratories are as follows:

- Computer Vision: robot navigation; industrial computer vision; knowledge-based vision systems; machine architectures for vision; image processing algorithms and software.
- Human/Computer Interaction: experimental studies of human performance with computers; user interfaces for expert systems; programmer workstation and system development tools; training; on-line assistance; and documentation.
- Robotics: control systems; kinematics; dynamics; computer-aided design; manufacturing automation; modeling and identification; artificial intelligence; locomotion; structural design; applications.

Center for Business and Public Policy: Director: Frank E. McLaughlin. Housed in the College of Business and Management, the Center seeks to encourage more effective public policy development in the contemporary social and political environment. It conducts and promotes research and dialogue among members of the affected groups and public officials concerning the broad pattern and changing character of business and society relationships. The Center also directs attention to specific public policy issues through conferences and seminars, and it emphasizes the study of more effective approaches to the resolution of disputes involving business and society. In addition, the Center publishes and distributes a wide range of documents reflecting its work.

Comparative Education Center: Director: George A. Male. Established in 1967, the Comparative Education Center provides cross-cultural encouragement and assistance

to faculty and students with international education interests. Center staff members represent special competence on Western Europe, Africa and the Near East as well as international organizations.

The Center arranges study visits for educators from other countries, holds symposia and occasional lectures and periodically publishes research essays on international education topics. The Center is associated with the Department of Education Policy, Planning, and Administration.

Computer Science Center: Director: Dr. Glenn Ricart. The Computer Science Center (CSC) is responsible for providing the academic computing infrastructure for the University. The Center provides a wide array of computing hardware, software and support services to faculty, staff and students.
The University's research and instructional needs are served by IBM 3081 and 4381 systems, a Unisys 1100/92 system and three DEC UNIX-based computer systems. Languages (e.g., FORTRAN, Pascal, COBOL, C), statistical software (e.g., SAS, SAS/GRAPH, SPSSx, BMDP) and a relational database (SQL) are among the services available on these systems. For qualified users with large-scale computing needs, the Center provides access to a Cray Y-MP8/864 at the San Diego Supercomputer Center.

The Center serves as a role model in the field of networking. Networking at UMCP is based on the TCP/IP protocol, with broad band coaxial cable serving as the main campus network backbone, which provides high-speed Ethernet communications. This network, UMDNET, also provides access to national and international networks such as the Internet, BITNET, ARPAnet, NSFnet and SURAnet. Dial-up ports are available at 300, 1200, 2400 and 9600 baud rates. Access to the Center's computers is also supported by local connections to a data Gandalf switch. Electronic mail is available on machines connected to the campus network. A campus-wide fiber optic telecommunication system is currently being installed around the campus with a completion date of August 1990.

The Center currently maintains five public Workstations at Maryland (WAM) labs located in the Computer Science Center, Hornbake Library, the Engineering and Physical Sciences Library (EPSL), and Worcester and Centreville Halls. These labs are open to students and faculty seven days a week and feature IBM PS/2 model 50s, Apple Macintosh IIs, DEC VAXstation 2000s and First-Aid, with NeXT machines in selected labs. In addition, the Center supports numerous other public computing labs across the College Park campus. The free handout, *Where to Go to Find . . . a Computer*, available in the CSC Program Library, features locations, hours and equipment available in all of these facilities.

Many support services are available for faculty, staff and graduate researchers using Center-sponsored computing resources. The CSC Consulting Lab (405-1500, Room 3326) provides phone-in and walk-in consulting service. The Program Library (405-4261, Room 3326) provides access to documentation, manuals, books and software. The Program Library also administers the distribution of site-licensed software and a PC-loaner program for UMCP faculty and staff. Non-credit Short Courses are given each semester in the CSC Faculty/Staff MicroLab. The *CSC Link* newsletter informs CSC users of new software, hardware and policies, and *Computer Swapshop* provides a means for campus groups and individuals to advertise used or needed equipment.

The Computer Emporium (405-5825) sells computer, software and related peripherals to UMCP faculty, staff and students at prices reflecting educational discounts.

For more information about the Computer Science Center services, call the CSC Consulting Lab at 405-1500.

Council for Curriculum Development and Change: Director: Steve Selden. The Council is committed to working with public and private schools, schools of nursing and medicine, business and industrial organizations, museums, and governmental and private agencies on issues pertaining to curriculum development and change.

The Council serves these groups on plans for designing, implementing and evaluating curriculum programs; advanced study and inservice education for faculty and administrators; networking and identification of specialized experts in the curriculum field; and development of national and international curriculum programs and exchanges. The Council is associated with the Department of Education Policy, Planning and Administration.

Dingman Center for Entrepreneurship: Director: Dr. Charles Heller. The Center is part of the College of Business and Management. Established in 1988, the Center furnishes direct assistance to new and emerging growth business in the Mid-Atlantic region, provides entrepreneurship courses to business students and develops a body of scholarly research on timely entrepreneurial topics.

The Dingman Center's academic program consists of a concentration in New Venture Creation and Entrepreneurship. Composed of five courses, the concentration is based on a proven model of entrepreneurship that maintains that new business success is the result of how well the entrepreneur, his or her business idea and the financing of that idea all fit together.

For more information about the Center, call 405-2149.

International Center for the Study of Education Policy and Human Values: Director: Barbara Finkelstein. The Center organizes research and development programs that engage humanities scholars, teachers, school administrators, public officials and educators from several nations in cooperative research and development programs focussing on issues of compelling ethical and political importance in the study and practice of education. The Center organizes studies, creates programs, generates publications and provides consulting services in three areas:

- Intercultural Education and Communication
- The Child, the Family, Education and the State
- Humanities and Civic Learning Policy

The Center organized and directs the Mid-Atlantic Region Japan-in-the-Schools Program, a National Intercultural Education Leadership Institute and a National Precollegiate Japan Projects Network. It has organized teacher education programs for National History Day, provides consulting services to museums, educational television stations, global education agencies and school systems, and cultivates research and curriculum development partnerships between Humanities scholars, school systems, the diplomatic corps and educators in the United States and in Japan.

The Center is part of the Department of Education Policy, Planning and Administration.

Center for Educational Research and Development (CERD): Director: Dr. John T. Guthrie. The Center for Educational Research and Development (CERD) is a research facility devoted to promoting the study of analysis and complex issues in education. The problems addressed include student learning and development, teacher effectiveness, curriculum theory, policy analysis and the social context of education. Issues are examined through a variety of methodologies including qualitative approaches, surveys, correlational studies, experiments and philosophical/literary analysis. The Center communicates its findings broadly, attempting to bring new knowledge to the attention of educational decision makers and the public through a variety of publication outlets.

The Center provides service to College staff in the development of scholarly activities. Assistance is given in the areas of literature retrieval and review, research design and analysis, and the communication of findings. Preparation of grant proposals including financial preparation, monitoring and accounting is supported. In order to conduct research activities and sustain communication on the application of new knowledge to educational problems, the Center provides a liaison with local, state and national education agencies. Collaborations of educational, corporate and university communities engaged in common research pursuits are facilitated.

Family Service Center: Director: Dr. Carol A. Werlinich. The Family Service Center (FSC) was established in 1980 by the Department of Family and Community Development. The mission of the Center's multifaceted programs is to enhance the quality of life for Maryland families and the communities in which they reside.

The Center offers: (1) direct marital and family therapy service; (2) a variety of therapy groups for couples, single parents, adolescents and their families, etc.; (3) publication of **The Maryland Family**, a vehicle for the optimal functioning of families in the community; (4) the locus for clinical data collection and research; and (5) the primary training site for the department's clinical students.

Of these activities, therapy training and direct services to families are central. For 10 years, the Center has helped train more than 100 family therapy professionals, and the Center provides marriage and family therapy services to over 350 Maryland families each year. No family is refused service because of an inability to pay. The Center has a full-time staff as well as associated faculty members and graduate students.

Family Research Center: Director: Dr. Roger H. Rubin. The purpose of the Family Research Center (FRC) is to enhance family research opportunities by securing extramural funding and encouraging cooperative ventures within the University and with other institutions. A variety of ongoing and special research projects are operated in the Center from its facility on Knox Road. The current components of the center include the office of the District of Columbia Metropolitan Area Council on Family Relations; the international office of the Groves Conference on Marriage and the Family; the Marriage and Family Therapy Group project; the Anne Arundel County Drug and Alcohol Training and Prevention Program; and the Ford Foundation/Lilly Foundation study of the role of the Black Church in Family and Community Life.

The Family Research Center is associated with the Department of Family and Community Development.

Center for Global Change: Director: Alan S. Miller. The Center for Global Change received a two-year $1.8 million grant from the Environmental Protection Agency to

address global environmental issues by integrating relevant scientific research on atmospheric change with policy and technological options that might serve to abate or ameliorate such changes. By coordinating and interacting with the University's scientific and academic resources, the Center brings together scientists and policy analysts from a range of fields to define programs of scientific research, policy analysis and education. Building on its scientific base, the Center identifies technologies and policy strategies that reduce pollution and support important societal goals, particularly economic growth. The Center funds University faculty to conduct primary scientific research focused on global change and it also supports several graduate students. The Center is jointly sponsored by the College of Behavioral and Social Science and the Colleges of Agricultural and Life Sciences.

Industrial Relations and Labor Studies Center: Director: Paul A. Weinstein. The program of Industrial Relations and Labor Studies at UMCP is concerned with two kinds of activities. The first is interdisciplinary research directed primarily toward the study of labor-management relations, wages and related problems, the labor market, comparative studies and personnel problems. The Center draws on the expertise and interests of faculty from the College of Business and Management, the School of Law and the Departments of Economics, History, Psychology and Sociology. The second main activity consists of community and labor relations education projects serving management, unions, the public and other groups interested in industrial relations and labor-related activities. These projects consist of public lectures, conferences, and symposia as well as non-credit courses. Planning for the development of a Master's degree in Industrial Relations and Labor Studies is underway.

Center for Innovation: Director: Jerald Hage, Co-director: Phil Favero. The Center for Innovation has two major programs of research. The first looks at the consequences of investments in human capital and in technology or more generally the growth in knowledge on the nature of organizations, including their performances, and on economic growth in the larger society. Special attention is given to the role of innovation for both of these problems. The second program examines the political economy of local economic and institutional development in Maryland and in various developing countries. While the two programs overlap in the intellectual content, they involve quite different research agendas. The first program is primarily concerned with the development of new sociological and social science theories while the second involves action research projects designed to create institutional and economic change. Both are interdisciplinary. The Center is an active member of the Science, Technology and Society program at the University of Maryland and is supported by both the College of Behavioral and Social Sciences and the College of Agriculture as well as grants from various funding agencies.

Center for International Development and Conflict Management (CIDCM): Acting Director: Abdel R. Omran. Established in 1981, the Center is a think tank and research unit that focuses on the study, management and resolution of protracted institutional conflict, population pressures and related issues of political, economic and social development.

The Center's activities pursue three goals, consistent with the mission of the University of Maryland: research, service and teaching.

Research at the Center is organized in projects, which currently include: a) Conflict Theory and Management Strategies; b) Regional and Country Studies; and c) Popu-

lation and Development. The Center's current area studies and projects include: Central American Project, Studies on Reproductive Health in Latin America, Studies on Israel, Studies on Korea, Studies on Lebanon, and the Middle East and South Africa Projects.

Composed of university faculty and visiting fellows and associates, the Center's staff studies dozens of contemporary international and intercommunal conflicts, their causes, dynamics, management strategies and peaceful resolutions. Through the Conflict and Peace Data Bank and Minorities at Risk Project, the Center also identifies communities potentially involved in conflict and also maintains a comprehensive global data bank featuring events data on 140 nation-states and more than 250 ethnic communities worldwide.

Service to the wider community of scholars and to the public includes: sponsoring public lectures, seminars and policy round-table discussions on a variety of contemporary issues, and hosting resident and visiting scholars and fellows from the United States and other parts of the world.

Teaching faculty members and fellows of the Center work closely with the teaching departments of the University of Maryland in organizing and teaching undergraduate and graduate courses and seminars.

Center for International Security Studies at Maryland: Director: Catherine M. Kelleher. First established in 1984 as the Maryland International Security Project, the Center for International Security Studies at Maryland provides university-wide opportunities for research, training and publication in the field of international security and foreign policy. The Center works with many campus colleges and departments to provide conferences, guest lectures and special seminars throughout the year on topics that relate to the complex challenges of achieving peace and security in the 1990s. Curriculum development includes such courses as: Economic Analysis and International Security; Alliance Relations; Science, Technology and National Security; and Ethics and National Security Policy. Each year, the Center invites a multinational group of junior and senior scholars here to work with the Center's faculty, staff and students on a variety of individual and collaborative projects. The Center also maintains an archive of selected historical materials in international security affairs. Current collaborative projects include Economics and National Security, the Nuclear History Program and Women in International Security.

Latin American Studies Center: Director: Saul Sosnowski. Housed in the Department of Spanish and Portuguese, the Center promotes and coordinates research and conducts related activities among Latin Americanist scholars from the University and institutions in Latin America and the Caribbean. The Center encourages the development of academic programs and seeks to enrich the University's intellectual life through its multidisciplinary approach to the study of the region. The Center also holds conferences and symposia on a variety of issues and sponsors the publication and distribution of the resulting volumes and of occasional papers. The Center is the home of the wide-ranging "Discovering the Americas" program (1987-1993) and the residency site for the Rockefeller Foundation Fellowships in the Humanities.

The Maryland Center for Quality and Productivity: Director: Tom Tuttle. The Maryland Center for Quality and Productivity operates within the College of Business and Management. Established in 1977, the Maryland Center promotes productivity, quality and labor-management cooperation in Maryland. The Center helps organizations develop

productivity measurement systems, employee involvement programs, productivity gainsharing systems, joint labor-management projects and other "tactical" improvements.

The Center has four major functions: 1) to foster increased quality and productivity and to increase competitiveness through direct technical assistance to public and private sector organizations in Maryland; 2) to act as a clearinghouse for information about quality and productivity and publish a bimonthly newsletter, "The Maryland Workplace"; 3) to increase knowledge levels about quality and productivity in Maryland through the regular curriculum of the University, as well as through training programs sponsored by the Center; and 4) to conduct research that adds to the body of knowledge about quality and productivity.

The Center has two offices; the College Park office handles consulting and training activities and the Baltimore office conducts quality and productivity assessments for Maryland manufacturing firms.

Center for Mathematics Education: Director: Dr. James T. Fey. The Center for Mathematics Education facilitates a graduate program in mathematics education relating mathematics, psychology and learning. The Center provides a setting in which graduate students, faculty, participating children, parents and appropriate visitors can become involved in the formal and informal interactions so essential to applied research on the learning and teaching of mathematics.

In support of its graduate program, the Center sponsors two major projects: the Mathematics Clinic and the Mathematics Teaching Laboratory. The Mathematics Clinic provides a setting where graduate students can study the teaching and learning of mathematics as they work directly with students in grades 1-12 who have difficulty learning mathematics. Models and procedures for the diagnosis and remediation of learning difficulties in mathematics are tested and refined in the Clinic.

The Mathematics Teaching Laboratory provides an extensive array of materials for teaching elementary school mathematics that Center faculty and graduate students not only evaluate but also use in their work with children or pre-service teachers.

Center for Studies in Nineteenth-Century Music: Director: H. Robert Cohen; Associate Director: Luke Jensen; Research Coordinator: Gaetan Martel. The Center promotes research focusing on nineteenth-century music and musical life. The center's programs are designed to facilitate the study, collection, editing, indexing and publication of documentary source materials considered invaluable for furthering research in this area. The Center also promotes research focusing on the development of computer programs and laser printing techniques that permit both the realization of internationally coordinated scholarly undertakings dealing with immense amounts of documentation and the production of scholarly publications in a camera-ready format. The Center currently produces the *Repertoire international de la presse musicale* (100 projected volumes, under the auspices of the International Musicological Society and the International Association of Music Libraries); the *First Edition of the Music Criticism of Hector Berlioz* (11 projected volumes in collaboration with France's Ministry of Culture and scholars at the Paris Conservatory and at the University of Quebec in Montreal); the monograph series *Musical Life in Nineteenth-Century France* and the journal *Periodica Musica*. The Center welcomes the participation of graduate students, offering an opportunity to participate in internationally sanctioned research programs.

Center for Neurosciences: Director: Dr. William Hodos. The Center for Neurosciences coordinates a program of training and research to bridge the communication gaps between campus departments by providing introductory minicourses, individual tutorials, colloquia and a journal club so that students can acquire fundamental principles and data in fields of neuroscience specialization other than their own.

Advanced training and research opportunities exist in areas such as computer science; behavioral and neuro-endocrinology; neurophysiology and membrane biophysics; neuroanatomy; ethology and neuro-ethology; ingestive behavior, ingestive physiology and nutrition; sensation, perception and psychophysics of humans and animals; neurolinguistics and communication in animals and humans; visuo-motor control systems; sensory biology; cognitive neuroscience; and neural- network modeling. Graduate students may apply to become Center Fellows and receive support for travel to scientific meetings and research support. Individual departments offer teaching and research assistantships, fellowships and support for minorities. Post-doctoral research and training opportunities exist as well.

Center for Ocean-Land-Atmosphere Interactions: Director: Dr. J. Shukla. Housed in the Department of Meteorology, the Center for Ocean-Land-Atmosphere Interactions (COLA) was established to foster interdisciplinary research and to increase our understanding of the physical processes and interactions of the oceans, atmosphere and the land surface. A better understanding is essential to enable us to distinguish between the natural variability of the coupled system and changes caused by external forces or human activities. Some of the important objectives of the Center are to study the contributions of internal dynamic processes and the slowly varying boundary conditions at the earth's surface in determining the variability and predictability of short-term climate, and to explore the feasibility of dynamic prediction of monthly and seasonal averages. Specific atmospheric, biospheric and oceanic studies currently conducted by the Center are listed below:

1. Study of physical mechanisms that determine the interannual variability and predictability of monthly and seasonal averages.
2. Mathematical modeling of large-scale atmospheric processes and predictability of the coupled ocean-atmosphere-land system.
3. Study of climatically significant feedbacks operating between the land surface and the regional and global circulation using a biologically and physically realistic model of the atmosphere and biosphere.
4. Investigation of the use of satellite remote sensing data in initializing and validating the combined atmosphere-biosphere model.
5. Research on mesoscale coastal modeling and tropical ocean modeling.
6. Four-dimensional assimilation of ocean data using realistic ocean models.

Center for Political Participation and Leadership: Director: Georgia Sorenson. The Center was established in 1989 to foster and encourage young people to prepare for elective office and community service. Special attention is paid to students from groups historically under-represented in the political spectrum. In addition, the Maryland Project for Women and Politics operates as an independent program within the Center. Closely affiliated with the academic departments in the College of Behavioral and Social Sciences, the Center has established internships and Fellowships for undergraduate and graduate students with Maryland senators and delegates, the Women's Leg-

islators of Maryland, the Offices of the Governor and Lt. Governor and Cabinet members. The Center also has placements on Capitol Hill and in county and elected offices around the state. Special research fellowships have also been funded.

Other Center activities include seminars, technical assistance and prominent speakers related to political leadership. An annual training program for political leadership, the "Evolutionary Leadership Conference," attracts participants from across the country and around the world.

National Center for Postsecondary Governance and Finance: The National Center for Postsecondary Governance and Finance conducts programs of policy research and disseminates its conclusions to those who can use these findings, including the general public. The Center's work focuses on improvement of governance, management and finance practices in higher education. Its activities in these areas are expected to contribute to the broader goal of improving the effectiveness, efficiency and equity of postsecondary teaching, research and public service.

The Center serves two primary audiences. Its principal audience is those who govern colleges and universities and those who formulate and approve policies that guide these institutions' development. Another major audience is the researchers and scholars who are concerned with higher education governance, management, and finance. Practitioners in higher education are relied on for help in selecting project topics, carrying out research, and disseminating findings. The Center's National Advisory panel provides critical guidance on the Center's activities and its selection of new projects and future program priorities.

Reading Center: Director: Linda B. Gambrell. The Reading Center provides support services for undergraduate and graduate students in the area of reading education. The Center's faculty believe that a positive learning environment facilitates learning; they are continuously searching for ways to improve reading instruction.

The Center operates a diagnostic and remedial clinic in which graduate students work with children who have mild to severe reading difficulties. Clinical diagnosis and instruction are of the highest quality and are closely supervised. Hundreds of graduate students have refined their diagnostic and remedial instructional skills in the clinic, which has assisted more than 2,000 children. The clinic also provides a pool of research subjects for faculty and graduate students.

The Center facilitates faculty research through awarding small grants, obtaining research subjects and sponsoring staff development in such areas as research design and statistical procedures.

Collaborative efforts are made with other UMCP faculty as well as with the Maryland State Department of Education and the local schools. These efforts have resulted in interdisciplinary classes, conferences and research projects. Faculty and graduate students aid local schools by conducting inservice activities, consulting on curriculum development and providing support to parent organizations.

Center for Renaissance & Baroque Studies: Director: S. Schoenbaum (UMCP). Executive Director: Adele Seeff (UMCP). Housed in the campus' College of Arts and Humanities, the Center for Renaissance & Baroque Studies was established in 1981 to serve all disciplines within the College of Arts and Humanities.

The Center has several objectives: to promote interdisciplinary research and teaching among faculty in Renaissance and Baroque studies; to support and publicize faculty research projects; to promote closer relations with major research centers in the Washington and Baltimore areas; to strengthen ties with faculty in humanities disciplines from regional colleges and universities; to enrich the life of the University and area community through lectures, conferences, exhibitions, concerts and other public presentations; and to consolidate ties between university and secondary school faculty in Maryland.

The Center sponsors projects such as the scholar-in-residence program, which appoints a distinguished scholar for a semester to teach, lecture and conduct faculty colloquia; a visiting actor program; an annual interdisciplinary symposium; the Maryland Handel Festival; and yearlong programs and summer institutes for secondary school teachers in Fine Arts and Shakespeare.

Center for Research in Public Communication: Director: Michael Gurevitch. Associate Director: Jay Blumler. Established in 1972, the Center for Research in Public Communication serves today as an institute dedicated to the study of the structure and processes of journalism, public relations, advertising and other forms of mass communications.

The Center's philosophy has three elements: 1) stress on the holistic character of the public communication process; 2) concern with comparative cross-cultural research; and 3) policy orientation. This philosophy underlies such studies as the relationship between journalists and their news sources; the interactions between public relations departments, activist groups and government; and the role of mass media in different societies.

Some examples of planned and on-going projects include a study of the role of the media as sources of interpretative frameworks by which people give meaning to their awareness of social issues; a study of interactions between candidates and journalists in setting the agenda of campaign issues in recent British and U.S. elections; and a five-year study, funded by the foundation of the International Association of Business Communicators (IABC), on the characteristics of "excellent" public relations departments and how those departments contribute to the effectiveness of their organizations; a study of the structure and the contents of television news exchanges among members of the European Broadcasting Union; and a study of "The New Television Program Marketplace" that examines the implications of changes in the marketplace for television programs upon the diversity, innovation, quality and creative freedom in American television programming.

Center for Rotorcraft Education and Research: Director: Prof. Alfred Gessow. The Center for Rotorcraft Education and Research operates within the Department of Aerospace Engineering and is one of three Centers of Excellence in Rotorcraft Technology created by the U.S. Army Research Office. The purpose of the Center is to expand the rotorcraft technology base through the conduct of research and the training of M.S. and Ph.D. rotorcraft specialists.

Graduate studies and research are conducted in rotorcraft aeroelasticity, vibrations, structural dynamics and composite structures. The Center conducts a broad range of analytical, computational and experimental research, with major projects in helicopter rotor blade tip aerodynamics, rotor-body interactional aerodynamics, rotor aeroelastic

stability, delamination of composite structures, structural couplings of composite blades, and unsteady and circulation control aerodynamics. The studies are conducted by the faculty and graduate students and are supported primarily by grants and contracts from a number of federal agencies.

The facilities for experimental research include several wind tunnels, the Composite Research Laboratory (CORE), a rotorcraft model rig, a rotorcraft hover test facility, a rotor vacuum chamber, a structural dynamics laboratory, two shops for model and fixture fabrication and a laboratory computer network for data acquisition, reduction and presentation. The Glenn L. Martin wind tunnel, with its 8 foot high by 11 foot wide test section has a speed range of up to 330 feet/second. It is maintained as an up-to-date facility used extensively for development testing by industry as well as for research work. There are two smaller subsonic tunnels that are heavily used in departmental research programs. Extensive instrumentation is available, including flow visualization systems and a laser anemometer. The Composite Laboratory is composed of an autoclave, a filament winding machine, an MTS 220 KiP uniaxial testing machine, an x-ray machine and an environmental chamber. It allows a full spectrum of specimen manufacture, preparation, inspection and testing. Two rotor rigs are available to test articulated and bearingless rotors in the wind tunnel. The hover facility was developed to accommodate rotors up to six feet in diameter. A 10-foot diameter vacuum chamber provides a capability to study the structural dynamics characteristics of spinning rotors. Blades can be excited by piezoelectric crystals.

The Center offers a broad range of financial aid options to graduate students. Graduate teaching and research assistantships are available that begin at $12,000 per year plus tuition and fees. In addition, numerous high paying fellowships are available, such as the Glenn L. Martin Fellowship ($15,000) and Rotorcraft Fellowships ($14,000 and up). These fellowships pay for tuition and fees in addition to the noted stipends.

For additional information concerning the graduate program or application procedures, please write or call: 405-1129

Professor Alfred Gessow
Department of Aerospace Engineering
University of Maryland
College Park, MD 20742

Science Teaching Center: Director: Dr. John W. Layman. The Science Teaching Center, through the Department of Curriculum and Instruction, offers master's and doctoral degrees specializing in science education. Students may focus their studies on research in:

- science curriculum development, evaluation and implementation
- interactive computer systems
- problem solving and inquiry processes
- science classroom processes and management
- learning science in non-school settings
- studying how students learn science
- science and learning from texts and visuals
- science teacher development

In addition, other education topics at the elementary, secondary and post- secondary levels directly related to the learning and teaching of science can be pursued.

Currently, the Center consists of six professors, a support staff and 40 active master's and doctoral students. Faculty members collaborate with graduate students to actively engage in research in new technologies, reading comprehension and classroom processes. A comprehensive collection of curriculum materials and documents enhances the functioning of the Center.

Flexible course requirements allow students to develop competence in the theory and research of science education, as well as in a science discipline. Graduate students consult with a faculty adviser to develop a program of study that meets their needs and interests. The core of the student's program consists of coursework in science education, research methodology and science.

Center for Substance Abuse Prevention and Control: Acting Director: Dr. Charles Wellford. Housed in the Colleges of Health and Human Performance, and Behavioral and Social Sciences, the Center provides a locus for research on substance abuse for faculty at College Park and throughout the University system. The Center also assists in the translation of research and related analysis into effective public policy. In addition, the Center promotes collaboration among researchers across the campus, the UM system, the state and the nation.

Center for Superconductivity Research: Director: Richard L. Greene. The Center for Superconductivity Research directs interdisciplinary research in basic and applied superconductivity. The more than 15 faculty members associated with the Center have appointments in the Physics, Chemistry, Electrical Engineering and Materials Science departments. The Center's goals are: 1) to increase knowledge of the phenomena of superconductivity and of superconducting materials; 2) to train students needed for future superconducting technologies; and 3) to interact with industry in the development of superconducting applications.

The Center emphasizes graduate programs and research although undergraduate participation is encouraged. The active research program of the faculty, research associates, students and visiting scientists is recognized worldwide and serves as a focus for the latest information on the science and technology of superconductivity.

Survey Research Center: Director: Stanley Presser. The Survey Research Center was created in 1980 as a research facility within the College of Behavioral and Social Sciences. The Center specializes in the design of questionnaires and the conduct of surveys for scholarly and policy purposes. The Center provides assistance to researchers in sample design, questionnaire construction, survey administration, and data entry and coding of questionnaires.

The Center provides both technical training and practical experience to students. It also has a strong community service mission; it provides technical assistance on survey methods and survey design to units of state and local government, and it conducts surveys on a contract or grant basis for these government units. Twice a year, the Center conducts the Maryland Poll, a statewide survey regarding public policy issues.

Systems Research Center: Director: John S. Baras. The Systems Research Center (SRC) at the University of Maryland and Harvard University promotes a unique approach to fundamental systems engineering research and education. Established in 1985 in the

National Science Foundation as one of the six original Engineering Research Centers, the SRC fosters basic study in the applications of advanced computer technology in the engineering design of high performance, complex automatic control and communications systems. Three colleges at the University of Maryland are involved in the Center: College of Engineering, College of Computer, Mathematical and Physical Sciences, and College of Business and Management. Harvard University's Division of Applied Mathematics is also involved. The Center's research activities are built around five interrelated focus application areas: Intelligent Servomechanisms, Chemical Process Systems, Manufacturing Systems, Communications and Signal Processing Systems and Expert Systems and Parallel Architectures.

Transportation Studies Center: Director: Everett C. Carter (UMCP). Housed in the College of Engineering, the Center acts as a catalyst to foster research, development and interdisciplinary studies in transportation. With the input from other departments of College Park and other campuses, the Center also provides the means for investigators from different disciplines to work together on a wide range of transportation-related problems. The Center's objectives are: to identify potential research projects by establishing a dialogue and rapport with sponsoring agencies and offices; to provide coordination between the various disciplines engaged in or having the potential to engage in transportation research and between potential research sponsors and University researchers; to facilitate cooperation for joint undertakings between the University of Maryland and other universities and industry; to promote and, where appropriate, to supervise specific educational programs of an interdisciplinary nature.

Among the areas identified for interest and research potential are transportation systems management, transportation planning, public policy, public utilities, systems analysis, mass transit systems, conservation of energy, terminal location, bridge and pavement design, traffic flow coordination, traffic safety and efficiency, transportation economics, air transportation, air pollution, noise control, highway design, environmental considerations, and air, rail, water and highway alternatives.

Water Resources Research Center: Director: Glen E. Gordon, Acting. The Water Resources Research Center sponsors and coordinates research on all aspects of water supply, demand, distribution, utilization, quality enhancement or degradation, and allocation or management. The Center joins University researchers and educators with water resource user groups, such as citizens groups and local, state and federal management and regulatory agencies to solve both basic and applied water resources problems. The Center sponsors research proposals that address water problems within the state and region and uses advisory committees to determine water resources problems that confront management, regulatory and health agencies and/or citizens of the state. The Center also brings together the technical expertise, financial resources and other contributions necessary to help solve existing water resources problems and to generate basic scientific information that may contribute to solutions of future problems or may prevent development of new water resource problems. The Center's funds are derived from the Water Resources Division, U.S. Geological Survey, under PL 98-242, and from substantial University contributions in faculty time and other expenses. Funds are made available for research projects on a competitive basis. The Center also trains graduate and undergraduate students in water resources and the transfer of existing water resources knowledge to user groups.

Center for Young Children: Director: Dr. Elisa Klein. The Center for Young Children is under the direction of the Early Childhood Unit of the Department of Curriculum and Instruction. It serves as a model of developmentally appropriate early childhood education and offers half-day and full-day programs for children three, four, and five years old whose parents are affiliated with the University. The Center is a research center and a teacher training site for the College of Education. Located in the Cambridge Complex, the Center has four classrooms and two research rooms that may be scheduled by faculty and graduate students.

Institutes

Institute for Advanced Computer Studies: Director: Larry Davis. Since 1985, the Institute for Advanced Computer Studies (UNIACS) has been the campus focal point for research activities in computing. The Institute has more than 50 faculty members and is conducting research in parallel processing, artificial intelligence, software engineering, distributed real-time systems and database systems. The Center shares many of its research programs with other departments including Computer Science, Electrical Engineering, Physics, Linguistics, Mathematics, Business and Management, Philosophy and Political Science. UMIACS jointly operates a Parallel Processing laboratory with the Center for Automation Research. This laboratory includes a 16000 processor Connection Machine. UMIACS annually publishes more than 100 Technical Reports and sponsors short courses, lecture series, workshops and conferences.

Institute for Child Study: Director: Robert C. Hardy. Founded in 1947, the Institute for Child Study is affiliated with the Department of Human Development, which offers graduate programs leading to the Master of Education, Master of Arts, Doctor of Philosophy and Doctor of Education degrees and the Advanced Graduate Specialist Certificate in human development across the life span. These programs have an educational psychology focus and provide a multidisciplinary approach to development across the life span. The Institute collects, interprets and synthesizes the scientific findings in various fields that are concerned with human growth, development, learning and behavior. Institute research is concerned primarily with social and cognitive aspects of development. The Institute provides extensive off-campus services to communicate current scientific findings in human development to those agencies and institutions that request such support.

Cooperative Institute for Climate Studies (CICS): One of nine such centers established by the National Oceanic and Atmospheric Administration (NOAA), the Institute fosters collaborative research between NOAA and the University in studies on radiation budget parameter estimation from space, climate diagnostics, modeling and prediction. The radiation budget estimation research is concerned with understanding and estimating the exchange of electromagnetic radiation within the global system, the major physical process driving its climate. The diagnosis and prediction studies are concerned with improving the understanding and prediction of climate anomalies on seasonal and monthly time scales. Technical advice is available on these and related atmospheric problems.

Institute of Criminal Justice and Criminology: Director: Charles Wellford. The Institute coordinates the University's interests and activities in the areas of law enforcement, criminology and corrections. The Institute has a very extensive and carefully integrated

undergraduate program. Special emphasis, however, is placed on graduate programs and on research.

The research capabilities and the academic programs of the Institute make possible the achievement of its primary goal the education of social and behavioral scientists who have chosen the problem of crime and its prevention and controls as their specialization. The Institute offers the M.A. degree with options in criminology or criminal justice and the Ph.D. degree in criminal justice and criminology.

Institute for Governmental Service: Director: Dr. Brian M. Gardner. The Institute provides information, consulting, research and technical assistance services to county, municipal governments and state agencies in Maryland. Assistance is provided in such areas as program evaluation, survey research, preparation of charters and codes of ordinances, budgeting and financial management, information systems and related local, state or intergovernmental management activities. The Institute analyzes and shares with governmental officials information concerning professional developments and opportunities for new or improved programs and activities.

Institute for Philosophy and Public Policy: Director: Dr. Mark Sagoff. The Institute for Philosophy and Public Policy conducts an interdisciplinary program of research and curriculum development, and it investigates the structure of arguments and the nature of values relevant to the formation, justification, and criticism of public policy. Most research efforts are chosen from topics expected to be a focus of public policy debate during the next decade. They are coordinated by Institute research staff and conducted cooperatively by working groups composed of philosophers, policymakers, analysts, and other experts from within and without the government. This diversity permits comprehensive examination of the major aspects of the complex issues investigated. Current research areas include: regulatory policy, environmental ethics, the nature of ecology, the rationality of attitudes toward risk, equality of opportunity, the ethics of legal negotiation, and the mass media and democratic values. Research products are made available through commercial publication, distribution of model courses, a quarterly newsletter, working papers, and workshops.

The Institute's curriculum development seeks to bring philosophical issues before future policymakers and citizens. Courses dealing with contemporary normative issues in the national and international arenas are offered through the School of Law, School of Public Affairs, and various undergraduate programs. Courses that have been offered include: Hunger and Affluence, Philosophical Issues in Public Policy; Human Rights and Foreign Policy; Ethics and Energy Policy; The Endangered Species Problem; Risk and Consent; Ethics and the New International Order; The Morality of Forced Military Service; Theory of Regulatory Policy; Ethics and National Security; and Environmental Ethics. The Institute operates within the School of Public Affairs.

Institute for Physical Science and Technology: Director: James A. Yorke. The Institute for Physical Science and Technology is a center for interdisciplinary research in pure and applied science problems that lie between those areas served by the academic departments. These interdisciplinary problems afford challenging opportunities for thesis research and classroom instruction. Current research topics include a variety of problems in applied mathematics, statistical physics, optical physics, fluid mechanics, physics of condensed matter, space science, upper atmospheric physics, engineering

physics and biomathematics. Other areas of interest are remote sensing, the effect of ionizing radiation on chemical systems, and the history of science and technology.

Courses and thesis research guidance by the faculty of the Institute are provided through the graduate programs in the academic departments of the College of Computer, Mathematical and Physical Sciences. The Institute sponsors a wide variety of seminars. Of principal interest are general seminars in statistical physics, applied mathematics, fluid dynamics and in atomic and molecular physics. Information about these can be obtained by writing the Director or by calling (301) 454-2636.

Institute for Research in Higher and Adult Education: Director: Robert O. Berdahl. The Institute's primary focus is to encourage and support the study of public policy issues concerning the relations between institutions of higher and adult education and their state and federal governments. The Institute concentrates on state level problems, including: 1) legislative performance audits of higher education; 2) evaluation of statewide boards of higher education; 3) interactions among statewide boards, accrediting agencies and universities; 4) fundraising and research development; and 5) inter-institutional cooperation. The Institute's location in College Park, next to the nation's capital, also facilitates monitoring and researching federal policies in postsecondary education.

Most of the Institute's faculty members are from the Department of Education Policy, Planning and Administration; however, interaction with students and faculty from other relevant areas is strongly encouraged.

Institute for the Study of Exceptional Children and Youth: Director: Philip J. Burke. Housed in the Department of Special Education in the College of Education, the Institute is a problem-centered organization engaged in innovation, research and evaluation related to major issues affecting the lives of exceptional individuals, including the gifted and talented as well as the handicapped. The Institute has five interlocking task areas: policy studies, consumer involvement and evaluation, leadership development, interdisciplinary studies and dissemination.

The Institute also administers research and demonstration programs in the areas of public policy urban special education, technology and international studies. In addition, it serves as a center for technical assistance to local schools and agencies with respect to needs of handicapped children and youth. The Institute focuses its resources on key issues, problems and research areas that will maintain a strong and independent voice in matters relating to exceptional children and youth.

Institute for Urban Studies: Acting Director: Sidney Brower. The Institute's mission is to generate and disseminate new knowledge of urban processes and urban functions. Institute faculty have particular interest in the interdisciplinary analysis, planning and management of contemporary urbanization, including such forces as economic development, information-age technology and employment, organizational behavior, policy formulation and public-private services. Both domestic and international urban development issues are researched.

The Institute for Urban Studies is an interdisciplinary bachelor's and master's degree granting unit. It was created to offer a learning program to educate urban professionals to plan, manage and develop metropolitan communities. The Washington-Baltimore urban corridor provides an excellent instructional and research setting for faculty and

students. Because contemporary urban problems must be solved by a multi-disciplinary approach, the master's programs are based on the Institute's core courses in combination with the specialized substantive knowledge offered by the University's diverse departments and professional schools. **NOTE:** In July 1989 the Institute merged with the Community Planning Program of the University of Maryland at Baltimore to create a new Department of Urban Studies and Planning. The merger will enable students to work toward a professional, accredited Master of Community Planning (M.C.P.) degree. Graduate degree requirements will alter substantially under the proposed curriculum changes; applicants should contact the Department for more information.

Offices

US-USSR Office of Joint Academic Initiatives: Established in 1989, the Office promotes inter-institutional research and exchange arrangements with counterparts in the Soviet and Eastern Europe academic communities. The campus also promotes commercial joint ventures with these areas to support academic activity. Part of the responsibilities of the Office is to facilitate such opportunities for development, particularly in technological and information science areas that may result through collaborations between Soviet and Eastern European scientists and their counterparts here. The Office's aims include: (1) to become a national center for the exchange of U.S./Soviet sciences and technology; (2) to expand on inter-institutional arrangements extending undergraduate, graduate and faculty exchanges in all areas, including the humanities and sciences; (3) to foment faculty and program development in this area on the UMCP campus; (4) to conduct research on the structuring and operation of exchange between U.S./Soviet science and technology; (5) to become a consulting organization to assist other U.S. universities develop similar programs. Thus far, the Office has signed two major agreements for research collaboration.

Laboratories

Laboratory for Coastal Research: Director: Stephen Leatherman. The Laboratory for Coastal Research is sponsored by the Department of Geography to support research and information dissemination about the processes and structure of coastal environments of the world in general and Maryland's coasts in particular. This Laboratory serves as a vehicle to enhance and facilitate cooperative efforts among coastal researchers within the University of Maryland system. The principal focus of and unifying factor for the Laboratory's activities is physical process research in coastal areas and related environment/socio-economic implications. In addition to theoretical and conceptual considerations, practical problems raised by the State of Maryland and federal agencies are addressed by Laboratory projects.

Laboratory for Global Remote Sensing Studies: Director: Samuel N. Goward. The Laboratory for Global Remote Sensing Studies is a research facility in the Department of Geography that is directed toward geographic research in regional, continental and global scale assessments of earth phenomena. Data sources include observations from earth-orbiting satellites such as the NOAA meteorological observatories, the NASA experimental Nimbus series, Landsat and SPOT. Current research focuses on spatio-temporal dynamics of terrestrial vegetation, its role in energy-mass exchange by the earth and the influence of human activities on the biospheric dynamics and on large area vegetation monitoring. This research is conducted with the support of grant funds from the National Aeronautics and Space Administration, the National Science Foun-

dation, the U.S. Department of Agriculture and other funding agencies. Four department faculty members, two research associates and 10 graduate research assistants currently participate in the laboratory.

Laboratory for Plasma Research: Director: Dr. Victor Granatstein. The University of Maryland's Laboratory for Plasma Research is internationally recognized for its outstanding contributions in both basic and applied plasma physics. Laboratory members include 23 teaching faculty spanning five different departments as well as 35 research faculty, 16 visiting scientists and 50 graduate students. Research activity is centered in the new University of Maryland's Energy Research Building, which houses experimental and computer facilities as well as a research library. Major ongoing experiments include spheromak (a spherical tokamak), free electron lasers for heating magnetic fusion plasmas, intense relativistic electron beams, gyrotron amplifiers for driving supercolliders and a low emittance electron beam transport experiment. Diagnostic equipment includes high power lasers and spectrographic apparatus covering the electromagnetic spectrum from x-rays to microwaves. Computational facilities include access to the CRAY XMP and II computers at the Magnetic Fusion Energy Computer Center as well as a number of in-house computers including the FPS 264.

Research and Development Laboratory on School-Based Administration: Director: Edward J. Andrews, Jr. This laboratory is the research and development unit of the Maryland Commission on School-Based Administration and the Maryland Assessment Center project. Housed in the campus Department of Education Policy, Planning and Administration, the Laboratory's focus is the professional preparation and inservice development of school principals. It collaborates in these efforts with the Maryland State Department of Education, other institutions of higher education and the 24 local school districts in Maryland.
The Laboratory's mission is to devise and activate a systematic plan to strengthen the effectiveness of school principals in Maryland through programs of principal assessment, professional preparation and development, and research on principal assessment and development.

Consortia

The University of Maryland is a member of a number of national and local consortia concerned with advanced education and research. They offer a variety of opportunities for senior scholar and graduate student research.

OAK RIDGE ASSOCIATED UNIVERSITIES, INC. (ORAU), is a non-profit educational and research consortium of 51 colleges and universities in the South formed in order to broaden the opportunities for member institutions collectively to participate in many fields of education and research in the natural sciences related to the environment, energy and health. Educational programs range from short term courses or institutes, conducted with ORAU facilities and staff, to fellowship programs administered by ORAU for the U.S. Department of Energy.

The National Center for Atmospheric Research (NCAR), was created to serve as a focal point of a vigorous and expanding national research effort in the atmospheric sciences. NCAR is operated under the sponsorship of the National Science Foundation by the UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH (UCAR), made up of 48 U.S. and Canadian universities with doctoral programs in the atmospheric sciences or related fields. The scientific staff includes meteorologists, astronomers,

chemists, physicists, mathematicians, and representatives of other disciplines. Over the years, UMCP Meteorology department, faculty, and staff members have had an active collaboration with NCAR colleagues and have made use of NCAR facilities. The Meteorology Department maintains a mini-computer that allows access to NCAR's CRAY 1 computer.

UNIVERSITIES RESEARCH ASSOCIATION, INC. (URA), a group of 52 universities engaged in high energy research, is the sponsoring organization for the Fermi National Accelerator Laboratory, funded by the U.S. Department of Energy. The accelerator, located near Batavia, Illinois, is the world's highest-energy proton accelerator. University of Maryland faculty and graduate students have been involved in experiments at Fermilab since its inception.

The INTER-UNIVERSITY COMMUNICATIONS COUNCIL (EDUCOM) provides a forum for the appraisal of the current state of the art in communications science and technology and its relation to the planning and programs of colleges and universities. The council particularly fosters inter-university cooperation in the area of communications science.

The Center for Excellence in Space Data and Information Sciences (CESDIS), which is located at the Goddard Space Flight Center in Greenbelt, Maryland, is jointly funded by the University of Maryland and the National Aeronautics and Space Administration through the UNIVERSITIES SPACE RESEARCH ASSOCIATION, a consortium of 62 universities. CESDIS has close ties to the Department of Computer Science at College Park. Two faculty members in the UMCP Department of Computer Science currently hold joint appointments with CESDIS and the director is a full professor in the department.

The Center began formal operation in Spring 1988 and has awarded several contracts for research projects in the academic computer science research community. CESDIS supports computer scientists working in close collaboration with space and earth scientists on problems of joint interest and those of direct relevance to NASA. The focus is on processing and managing data from space observing systems and conducting research on other applications of computer science to space data. For more information, contact: Dr. Raymond Miller, Director, Goddard Space Flight Center, Code 630.5, Greenbelt, MD 20771.

The UNIVERSITIES SPACE RESEARCH ASSOCIATION (USRA) was designed to promote cooperation between universities, research organizations and the government in the development of space science and technology, and in the operation of laboratories and facilities for research, development and education in these fields. USRA currently has four active research programs. They focus on low gravity cloud physics, computer applications in science and engineering, lunar science and materials processing in space.

The University of Maryland is a member of the INTER-UNIVERSITY CONSORTIUM FOR POLITICAL and SOCIAL RESEARCH (ICPSR). One purpose of the Consortium is to facilitate collection and distribution of useful data for social science research. The data include survey data from the University of Michigan Center for political Studies and from studies conducted by other organizations or by individuals, census data for the United States, election data, legislative roll calls, judicial decision results and biographical data.

The University of Maryland jointly participates in the CHESAPEAKE RESEARCH CONSORTIUM, INC., a wide scale environmental research program, with the Johns Hopkins University, the Virginia Institute of Marine Science and the Smithsonian Institution. The Consortium coordinates and integrates research on the Chesapeake Bay region and is compiling a vast amount of scientific data to assist in the management and control of the area. Each participating institution calls on faculty expertise in a diversity of disciplines including biology, chemistry, physics, engineering, geology, and the social and behavioral sciences. Through this interdisciplinary research program a computerized Management Resource Bank is being developed containing a biological inventory of the Chesapeake Bay region, a legal survey and socioeconomic data of the surrounding communities. The Consortium provides research opportunities for faculty members, graduate students and undergraduate students at the University.

Officially chartered in 1969, the SEA GRANT ASSOCIATION is a growing organization concerned with the development and wise use of ocean and Great Lakes resources. Composed of the nation's major colleges, universities and institutions with ocean programs, the Association works for the betterment of the management and utilization of marine resources. Maryland's research and education program is greatly involved with estuarine processes and commercial fisheries, especially oysters, in the Chesapeake Bay. Other important research efforts such as the joint cholera program with Florida, Louisiana and Oregon, represent strong national efforts.

The University of Maryland was awarded its first institutional Sea Grant funding by the Department of Commerce for the calendar year 1977. Although 46 universities, colleges and non-profit organizations hold either regular or associate memberships in SGA, Maryland is one of only about 20 who have comprehensive institutional programs and who are eligible to become Sea Grant Colleges.

The goal of the CONSORTIUM ON HUMAN RELATIONSHIPS IN EDUCATION is to involve all interested agencies in the State of Maryland in the identification, development and utilization of human resources for the purpose of improving human relationships in education. The consortium provides training activities for educational personnel, promotes the sharing of expertise among education professionals, disseminates information as to activities, personnel and materials concerning human relationships, and promotes cooperative relationships among the agencies involved.

Established in 1965, the UNIVERSITIES COUNCIL ON WATER RESOURCES (UCOWR), is a national consortium with approximately 80 members. UCOWR was created to provide a forum for interchange of information pertaining to water resources research in academic communities. Member institutions also exchange information on special conferences, seminars, symposia and graduate study opportunities.

The University of Maryland is an associate member of the UNIVERSITY-NATIONAL OCEANOGRAPHIC LABORATORY SYSTEM (UNOLS) established to improve coordinated use of federally supported oceanographic facilities, bringing together the Community of Academic Oceanographic Institutions that operate those facilities, and creating a mechanism for such coordinated utilization of and planning for oceanographic facilities. As an associate member, the University of Maryland operates research programs in the marine sciences and operates the University of Maryland Center for Environmental and Estuarine Studies.

Chartered in 1981-1982 with the University of Maryland among its founding members, the POTOMAC RIVER BASIN CONSORTIUM comprises 20 or so academic, gov-

ernmental and private sector institutions whose intent is to expand scholarly and popular interest and involvement with the many natural, cultural and historical dimensions of the Potomac Valley basin and its subregions and the Chesapeake Bay. Consortium interests range from agriculture, anthropology and engineering to historic preservation, environment, geography, history, public policy and urban studies. Consortium activities, which are intermural and interdisciplinary, are aimed at enhancing opportunities for collaborative studies of the region in academic curricula, student exchange, internships, workshops, seminars and a publication program of academic studies and papers.

The University of Maryland is one of the charter members of THE SOUTHEASTERN UNIVERSITIES RESEARCH ASSOCIATION (SURA), a consortium of 35 institutions of higher learning formed in 1980 for the purpose of managing large cooperative projects in science, engineering and medicine. SURA's first undertaking was the proposal for a National Electron Accelerator Laboratory (NEAL). Although NEAL's primary research potential is in nuclear science, research in condensed matter physics, medicine and industrial applications is a natural byproduct.

The purpose of the SOUTH-EAST CONSORTIUM FOR INTERNATIONAL DEVELOPMENT is to respond to the economic and social needs of limited resource peoples and less developed countries. Memberships in the organization is open to universities, research institutions and other organizations with capabilities related to rural and urban development and technology transfer. The University of Maryland is a charter member and has participated in several SECID technical assistance contracts including ones in Kenya, Sri Lanka, Sierra Leone, Guyana, Malawi, Zambia, Senegal and Mali.

The goal of the CONSORTIUM FOR INTERNATIONAL CROP PROTECTION (CICP) is to promote economically efficient and environmentally sound crop protection practices in developing countries. CICP sponsors training for developing country extension workers, researchers, agricultural and health officials, and others to help reduce dependence on chemical insecticides and foster a more holistic approach to pest control; fields research teams to assess plant protection problems; and provides specialists for other technical assistance.

The consortium, which operates under an $8.7 million, five-year authorization budget, most of which derives from the U.S. Agency for International Development, claims as members 13 U.S. universities and the U.S. Department of Agriculture. UMCP entomologist Allen Steinhauer serves as the executive director of CICP, which this spring moved to its new headquarters in College Park. Entomology professor Dale Bottrell serves as one of CICP's key personnel in his role as technical assistance specialist in entomology.

Incorporated in 1963, THE ORGANIZATION FOR TROPICAL STUDIES,INC. (OTS) is a growing consortium of 43 academic institutions, manages an annual budget of more than $2.5 million, owns one of the most well-equipped and best staffed tropical research stations in the world, and offers graduate courses in field ecology and agroecology. It is supported largely by major grants from NSF, several private foundations and member institutions. University of Marlyand was elected to membership in 1985; local OTS representatives are Douglas Gill, Zoology and Allen Steinhauer, Entomology.

OTS is a leader in education and research in tropical biology. Its principal course is "The Fundamentals Course in Tropical Biology: an Ecological Approach." Offered

twice a year in English, this 8-week course is taught in Costa Rica by a team of two dozen expert faculty. Twenty superior graduate students are chosen competitively from member universities in Northern and Latin America. Research opportunities offered by OTS include field stations and research fellowships for graduate students. OTS manages three research stations in Costa Rica.

The Laboratory for Millimeter-Wave Astronomy is the Maryland part of a three-university consortium known as the BERKELEY-ILLINOIS-MARYLAND ARRAY (BIMA). The other two members of the consortium are the University of California at Berkeley and the University of Illinois; The array provides support for the design and construction of a six-element millimeter-wave radio telescope at Hat Creek in Northern California and undertakes astronomical observations with the array. Five faculty members, five postdoctoral fellows, two programmers and several graduate students are affiliated with the lab, which is headed by Leo Blitz and is a semi-autonomous unit within the Astronomy Program.

BIMA currently has three antennas of the array operating and collecting astronomical data. The telescope is remotely operable from the Maryland campus, and data are automatically transferred to the campus once a day. The major scientific interests of the members of the array are the Sun, planetary radio astronomy, the interstellar medium, star formation, normal galaxies and active galactic nuclei. Currently, the main thrust of the development effort at Maryland is in software design and in expanding the array to longer baselines.

Student Services

Office of Graduate Minority Affairs

The Office of Graduate Minority Affairs, located in the Graduate School (2133 Lee Building), is charged with coordinating graduate recruitment and retention efforts campus-wide and advising minority students in all aspects of their programs. The Office acts as the student's liaison to the administration, reviews policies affecting the quality of graduate life and continues to improve academic opportunities for minorities.

In an effort to provide a multicultural environment, the Office of Graduate Minority Affairs will also underwrite those initiatives that highlight the racial and cultural diversity of the University community, promote interest in ethnic studies and multicultural programs and heighten awareness of issues pertaining to minority student identity. Although the main thrust of the Office's activities is directed toward students, it also assists the individual departments in addressing issues of diversity and the changing face of the graduate population. For more information, contact Dario Cortes (301-405-4183) or Carla Gary (301-405-4185).

Graduate Legal Aid Office

The Graduate Legal Aid Office provides free legal advice, referrals and assistance to currently registered University of Maryland graduate students. Staff members give general legal advice on a wide variety of matters, including landlord-tenant issues, consumer problems, traffic accidents, uncontested divorces and University-related matters. The Office provides direct legal assistance in routine matters, but CANNOT SUE ON BEHALF OF STUDENTS OR REPRESENT THEM IN COURT. The Office is staffed eight hours a week for student interviews; staff members see students on a walk-

in basis and by appointment. Walk-in and appointment schedules are posted on the Office door. For more information, contact the Office in Room 1221, Stamp Union.

Graduate Student Government

The Graduate Student Government (GSG) is the student government for graduate students. Its purposes are: (1) to improve the quality of education and enhance the quality of life of the graduate students; (2) to communicate and support research interests of graduate students; (3) to recommend members for policy-making and administrative committees of the campus; and (4) to act as the spokesbody for graduate student concerns.

Membership is open to all full and part-time graduate students enrolled in degree programs on campus. The Assembly of the GSG consists of representatives from each graduate department, but its meetings are open to all interested graduate students. Elections to the Assembly are held every year in the Fall and occur within the departments. Officers of the GSG are elected at-large in the Spring. The President of GSG is a full Graduate Assistant position in the Graduate School but is elected by the graduate student body.

The GSG has eight standing committees that perform the majority of governing responsibilities. Membership on these committees is open to all graduate students. Committees include the Executive, Elections, Social, Newsletter, Communication, Minority Affairs, Legislative Action and Graduate Research Interaction Day.

Departmental Graduate Student Organizations (GSOs) are active in most departments on campus and are directly supported by the GSG. Involvement in a GSO is not a prerequisite for GSG membership but is encouraged.

For more information, contact the Graduate Student Government, Box 105, Stamp Student Union.

Campus Senate

The Campus Senate, an integral part of the institution's system of governance, is somewhat unique in that it has representation from all segments of the campus community: administrators, staff, faculty, and undergraduate and graduate students. Participation in the Senate or any of its 14 standing committees is an honor and a responsibility.

The full Senate meets eight times a year to consider matters of concern to the institution, including academic issues, University policies, plans, facilities and the welfare of faculty, staff and students. The Senate advises the President, the Chancellor, or the Board of Regents as it deems appropriate.

Graduate students who wish to serve in the Campus Senate are nominated by the deans of their academic colleges and elected in an at-large, campus-wide election held in the spring. Students are also encouraged to participate on a series of Senate standing committees, such as Student Affairs and Human Relations. These committees draw membership from the campus community at large and cover every aspect of campus life and function. Students are sought every spring to fill the committee appointments. Details on the election and appointment processes are available through the Campus Senate Office, Room 0104A, Reckord Armory, phone: 405-5805.

Off-Campus Housing

Housed in the Office of Commuter Affairs, the Off-Campus Housing Service (Room 1195, Stamp Student Union, 454-3645) maintains an extensive and up-to-date com-

puterized list of rooms, apartments and houses (both vacant and to share) that are for rent in the area; they are organized by cost, type of housing and distance to campus. Personalized printouts tailored to your individualized needs can be requested (in person) to simplify your housing search. Be sure to bring your letter of admission or student ID when requesting a printout. Average monthly rates for housing in the area are: $200-$300 for a room in a private or student home; $400-$600 for an efficiency, basement apartment or one-bedroom apartment; $250-$300 for a shared apartment and $800-$1,250 for an unfurnished house. Maps of the College Park area, lists of local motels, real estate agents and furniture rental companies as well as information of general interest to commuter students are also available at the Service.

Graduate Housing

The University maintains 471 apartment units designated exclusively for eligible graduate students enrolled full time at the College Park campus. The apartments are located in two separate apartment complexes (Lord Calvert and University Hills), both within walking distance of the campus. Efficiency units are assigned to single and unaccompanied students, one-bedroom apartments to a married student and spouse, and two-bedroom units are assigned to a married student and spouse with not more than two children. Also, single parents may be assigned to two bedroom units. All two-bedroom assignments involve age restrictions for children.

To be eligible for an efficiency unit, a student must be the recipient of a teaching or research assistantship or be in receipt of a qualified scholarship, fellowship or grant as approved by the Graduate School. Two-bedroom units are more plentiful than either one-bedroom apartments or efficiencies and possession of a TA, RA or an approved stipend has historically not been a requirement to obtain this type of unit. However, this policy is subject to change based upon demand by students with qualifying stipends.

Assignment of all units is on a first-come, first-served basis. The waiting period for an efficiency averages 12 to 18 months, a one-bedroom usually takes two to four months, and the two-bedroom units average one month or less. Waiting periods often reflect a semester cyclic demand; waiting time for a one-bedroom unit is often longest in late summer and immediately after the start of the fall semester. Students pursuing a master's degree are eligible for 24 months of residency and Ph.D. students are allowed up to 48 months, which is also the maximum for a combination or sequence of both degrees. Residency may also be terminated on the last day of the month in which all the requirements for the degree are completed if that date is earlier than the respective 24 or 48-month eligibility limit.

The programmed monthly rental rates, effective July 1, 1989 and for the subsequent 12 months are: efficiencies, *$341*; one-bedroom units, *$395*; and two-bedroom units *$441*. Rental rates are adjusted (historically increased) on July 1 each year. All basic utilities (except phones) are furnished. The apartments are unfurnished with the exception of a stove and refrigerator. All apartments are centrally heated and centrally air-conditioned.

A $10.00 non-refundable application fee should be sent with the completed application, and a $200.00 security/damage deposit is required upon apartment assignment.

All payments to the Graduate Apartments must be in check or money order form and should be made out to The University of Maryland. Cash is not accepted. For additional information and an application form, please write or call:

University of Maryland
Graduate Apartments
3424 Tulane Drive #14
Hyattsville, MD 20783
Phone (301) 422-7445

University Dining Services

The University Department of Dining Services offers several dining options available to graduate students. The D.S. Cash Plan or the Resident Dining Plans offer students the ability to dine at various restaurants all over campus. The D.S. Cash Plan has a minimum deposit of only $50.00, which can be charged to Visa or Mastercard. The Resident Dining Plans start at about $975.00 per semester. Information on both plans is available from the Dining Services Contract Office (314-8068).

Dining Services features over 30 different restaurants and Eateries across campus. Menu offerings range from salad bars, grills, delis and fresh dough pizza to a sit-down restaurant and 18th century inn. All facilities are open to everyone, but students on board plans receive discounts and are entitled to specially priced meals. For more information, call 314-8054.

Career Development Center

The Career Development Center, located in Hornbake Library, offers a wide variety of services to graduate students. The goal of the Center is to assist students in exploring career opportunities and planning their career futures. Services include individual career counseling, a comprehensive Career Resource Center, frequent workshops at no charge and a variety of job search services, including the Credential Service, the On-Campus Recruiting Program, the Mini- Resume Referral Service and up-to-date job listings. Students interested in employment in the fields of education and library science will find the Credential Service especially valuable.

Graduate students are encouraged to participate in any of the CDC programs and services. The professionally qualified staff is also available to present special programs to classes, seminars, colloquia, and student associations. For more information, call 314-7225 or stop by the Career Development Center located at 3121 Hornbake Library, South Wing.

Counseling Center

The Counseling Center provides comprehensive psychological and counseling services to meet the mental health and developmental needs of graduate and undergraduate students. Records kept as part of providing counseling services are confidential and are not part of the University's educational records. The Counseling Center, located in Shoemaker Building, is open Monday - Thursday 8:30 a.m. - 9:00 p.m. and Friday 8:30 a.m. - 4:30 p.m.

In order to meet the needs of the campus community, the Counseling Center provides the following special services and programs:

1. Counseling Service. Psychologists provide professional individual and group counseling services for students with social-emotional and educational-vocational concerns. Counseling is available for individuals and groups to overcome depression, career indecisiveness, anxiety, loneliness and other problems. Workshops ranging from developing assertiveness and self-esteem to stress management are also offered. A 3:00 p.m. Minority Student Walk-in Hour is held daily. The Center also provides a series of tape-recorded interviews with all College Park department heads covering course and career options in their fields. Telephone: 314-7651.

2. Disabled Student Service (DSS). Professionals provide a variety of assistance for students with physical and learning disabilities. Services must be arranged in advance and students are encouraged to contact the office as early as possible. Located in Room 0126 Shoemaker, office hours are 8:30 a.m. - 4:30 p.m. Monday - Friday. Telephone: 314-7682 (voice) or 314-7683 (TDD).

3. Learning Assistance Service (LAS). Educational Specialists offer individual and group sessions for improving academic skills such as reading, writing, listening, note taking and learning mathematics and science material. Workshops cover such topics as study skills, time management, learning math skills, exam anxiety and learning English as a second language.

4. Returning Students Program. Ongoing consultation, counseling, referrals and orientation programs are provided to address the needs of students aged 25 or over who are beginning or coming back to school after a break in their formal education. Located in Room 2201 Shoemaker. Telephone: 314-7693.

5. Testing, Research and Data Processing Service. National testing programs such as the CLEP, GRE, LSAT, MCAT, GMAT and Miller Analogies are administered through this office, as well as testing for counseling purposes, including vocational assessment. In addition, the staff members provide a wide variety of research reports of characteristics of students and the campus environment. Telephone: 314-7688.

6. Parent Consultation and Child Evaluation. Professional help is available through consultation, testing and counseling for youngsters ages 5-14 and families. Telephone: 314-7673.

Health Care

The University Health Center is located directly across from the Student Union on Campus Drive. The Center provides primary care of illness and injury, health education and consultation, dental care, a men's clinic, a women's health clinic, skin care, sports medicine, physical therapy (located in the PERH building), nutritional counseling, mental health counseling, social services, lab services and a pharmacy. Individual and group health education programs are available on topics such as sexual health and contraception, stress management, substance abuse and sexuality and communication.

The Health Center is open 24 hours a day, seven days a week, with varied hours during semester breaks and holidays. Students are seen for routine care between 8:00 a.m. and 6:00 p.m. weekdays. All currently registered students are eligible for care. The cost of Health Center services is included in the student's health fee. All students are encouraged to carry hospitalization insurance. While the health fee covers most routine costs at the Health Center, there are additional charges for x-rays, lab tests, dental treatments, allergy injections and pharmacy supplies. All students' medical records are strictly confidential and may only be released with the student's consent or through court-ordered subpoena.

For information, call 314-8180 or 314-8182. Appointments, 314-8184; Pharmacy, 314-8167; Health Education, 314-8128; Health Insurance, 314-8165; Dental Clinic, 314-8178.

Health Insurance

Because the mandatory health fee is not a form of health insurance and many students do not have adequate coverage, a voluntary group insurance policy is available to students. This policy provides benefits at very reasonable rates for hospital, surgery, emergency, laboratory and x-ray purposes; some coverage for mental and nervous problems; and contains a major hospital provision. See information on your letter. Students may elect to have family coverage. For additional information and application forms, see the brochure available in the Health Center.

Teaching, research and graduate assistants are also eligible for the State Employee Insurance Plan options. Please note that fellows and hourly employees are not eligible for the plan. For further information, contact your department or the personnel benefits office.

Publications of Interest to Graduate Students

In addition to the Catalog, the Graduate School prepares the following publications:

Graduate Application Booklet. This booklet, which contains the application forms and information you need to complete the forms, is available on request from the Graduate School Mailing Office or from the individual departments.

Guide to Graduate Life. This handbook, designed to provide the new graduate student with an introduction to the campus and the College Park area, is available from the office of the Dean for Graduate Studies and Research.

Graduate Assistant Handbook. This handbook sets forth policies, procedures, and services of interest to graduate assistants and is available from the departmental graduate offices and the office of the Dean for Graduate Studies and Research.

The Theses Manual. This manual contains the instructions for preparation of theses and dissertations and is available from the Graduate School (Room 2117, Lee Building).

Important Dates for Advisers and Students. This calendar card of dates for submission of final documents is available from the various departmental graduate offices, as well as from the office of the Dean for Graduate Studies and Research.

GRADUATE PROGRAMS

Aerospace Engineering (ENAE)

Professor and Chair: Chopra

Professors: Anderson, Donaldson, Gessow, Lee, Melnik

Associate Professors: Barlow, Jones, Winklemann

Assistant Professors: Celi, Lewis, Leishman, Vizzini

Lecturers: Chander, Chien, Hagar, Heimerdinger, Kim, Korkegi, Lekoudis, Marks, Obrinski, Regan, Russell, Vamos, VanWie, Waltrup, Winblade, Yanta

The Aerospace Engineering Department offers a broad program in graduate studies leading to the degrees of Master of Science and Doctor of Philosophy. Those holding a B.S. in engineering, the physical sciences or mathematics are invited to apply to the program, which offers specializations in Aerodynamics and Propulsion, Structural Mechanics, Rotorcraft, Space Systems and Flight Dynamics. Within these areas of specialization, the student can tailor programs such as Computational Fluid Dynamics, Hypersonic Aerodynamics, Composite Structures, Finite Element Analysis, Aeroelasticity and Space Propulsion.

Admission and Degree Information

Both the master's and the doctoral programs are designed to meet the objectives and background of the individual student and are planned by the student and an adviser. No special Departmental requirements are imposed beyond the Graduate School requirements. The master's degree program offers both a thesis and a non-thesis option.

For the Doctor of Philosophy degree, the Department requires a minimum of 42 semester hours of coursework beyond the B.S. including: (1) not less than 18 hours within one Departmental area of specialization, (2) not less than six hours from among the other areas of specialization in the Department, and (3) not less than nine hours in courses that emphasize the physical sciences or mathematics. The total in (2) plus that in (3) must be at least 15 hours, 12 hours of which must be 600-level courses. Written qualifying and oral comprehensive examinations are also required.

Facilities and Special Resources

Facilities and equipment that support experimental studies in low-speed aerodynamics, structural dynamics, helicopter dynamics and aerodynamics, and composite structures include the Glenn L. Martin Wind Tunnel with a 7-foot, 9-inch by 11-foot test section, other open and closed section subsonic tunnels, a supersonic tunnel, a structural dynamics rig, a 10-foot diameter vacuum chamber for rotor tests, a model rotor test apparatus, a microprocessor controlled autoclave with a 3 by 4-foot working section, testing machines, including a 220,000-lb uniaxial test frame, and a laboratory minicomputer system for fully automated data acquisition. In addition to the mainframe computers available on campus, the Department currently maintains dedicated multiuser computer systems such as the Hewlett-Packard HP1000 E, HP9000, HP1000/A900 as well as 17 Sun Workstations, a file/computeserver and 12 MacIntosh II computers.

Financial Assistance

A number of graduate assistantships and fellowships, including the Glenn L. Martin, Rotorcraft and Hypersonic fellowships, are available for financial assistance.

Additional Information

For more information on the graduate program, contact:

Department Chair
Department of Aerospace Engineering
Engineering Classroom Building
University of Maryland
College Park, MD 20742
(301) 405-1121

For courses, see code ENAE.

Agricultural and Extension Education Program (AEED)

Acting Chair: Miller

Professors: Longest

Associate Professors: Rivera, Seibel, M. Smith, N. Smith

Affiliate Professors: Booth, Ingle, Oliver, Shelton

Adjunct Professors: Adams, Brown, Cooper, Flyger, Jarvis, Lear, Ross, Sieling, Soobitsky, Wisler

The Agricultural and Extension Education Program offers multidisciplinary programs that are organized into Agricultural Education; Adult, Continuing and Extension Education; Community Development; and Natural Resources Management majors.

Faculty members specialize in: teacher education; program administration and supervision; extension program management; staff and leadership development; policy development and evaluation; community analysis, development and leadership; organizational development and leadership; public affairs education; program management; natural resources management; and environmental education. Department faculty and graduate students also participate in interdisciplinary programs such as international extension and research, (working with the International Development Management Center, IDMC), ruralsociology, and natural resources management and environmental education (working with Marine-Estuarine-Environment Science (MEES) programs). A joint MS degree is offered in Agricultural Education with the University of Maryland Eastern Shore campus.

Admission Information

Applicants for all programs must present transcripts and recommendations from three individuals qualified to assess the academic abilities of the applicant. Results of the Miller Analogies and/or GRE tests must also be included with the application.

Degree Information

Student academic programs are built around core Departmental and major field requirements. Courses may be included from other departments and colleges as appropriate to the student's special interests and career aspirations.

The Department offers graduate degrees in Agricultural Education; Adult, Continuing, and Extension Education; Community Development; and Environmental Edu-

cation (M.S. only) with specializations in each. Both a thesis and non-thesis option are available for the Master of Science degree. An Advanced Graduate Specialist Certificate requiring 30 credits beyond themaster's degree is also available.

Doctor of Philosophy programs are designed to meet Graduate School and Department requirements and are planned according to the student's previouseducation, experience, special interests, professional plans and aspirations. No specific number of credits is required but is dependent on the student's qualifications and area of concentration. No foreign language is required but it is encouraged for those interested in international development. Research and major competencies will be developed through specific courses, Department research projects, and/or projects developed by the student as part of his or her academic program.

Facilities and Special Resources:

The campus graduate library and Computer Center provide excellent research resources for the graduate education programs. The Department also emphasizes interaction between faculty and graduate students representing an international and culturally diverse dimension.

The Department's proximity to Washington, D.C., where the national headquarters of many organizations and agencies are located, allows access toand interaction with key leaders and data sources. Some of the resources include: USDA, EPA, USAID National Agricultural Library, Library of Congress, International Development Management Center, World Bank, AEED Center for International Extension Development, NASULGC, National 4-H Center, andNational FFA Center.

Financial Assistance

Graduate assistantships are offered to qualified applicants on the basis of past academic performance and availability of funds. Many of the full-time students in the Department hold assistantships or other forms of financial aid.

Additional Information

For additional information on programs, admission procedures and financial aid contact:

Chair
Agricultural and Extension Education Department
0222 Symons Hall
University of Maryland
College Park, MD 20742
(301) 405-1255

For courses, see code AEED.

Agricultural and Resource Economics Program (AREC)

Professor and Chair: Hueth

Professors: Bender, Bockstael, Brown, Cain, Chambers, Foster, Gardner, Just, Lessley, McConnell, Stevens (Emeritus), Strand, Tuthill, Wysong

Associate Professors: Hardie, Lopez, Russell

Assistant Professors: Leathers, Lichtenberg, Horowitz

The Department of Agricultural and Resource Economics offers courses of study leading to the Master of Science and Doctor of Philosophy degree. The graduate program prepares students through courses in traditional subject matter areas, research experiences designed to give technical and creative competency in applied economics, and seminar and discussion opportunities.

The Department provides two areas of specialization, agricultural economics and resource economics. Study and research within these two areas of specialization can include agricultural development, international trade, agricultural marketing, production economics, agricultural policy, econometrics, land use, marine resources, water resources and environmental quality.

Substantial employment opportunities exist for persons with advanced training in agricultural and resource economics. Graduates from the Department obtain employment in government, industry and universities. Graduates are hired by such agencies as the U.S. Departments of Agriculture and Interior and the Environmental Protection Agency, and some obtain positions with the World Bank and similar agencies. Industry positions include management or program responsibilities. Graduates with academic interests are usually hired as assistant professors (teaching, research, extension) at major universities.

Admission and Degree Information

The M.S. degree program offers both a thesis and non-thesis option in both areas of specialization. The thesis option requires a minimum of 24 credits of coursework and six credits of thesis. The student must also take a final oral examination, which is primarily a defense of the thesis. The non-thesis option requires 33 credits of coursework, a scholarly paper and a comprehensive written examination, which is primarily concerned with coursework taken during the program.

The Ph.D. degree requires a minimum of 48 credits of coursework beyond the bachelor's degree and 12 credits of dissertation research. Qualifying examinations are administered on completion of core course requirements. An oral dissertation defense is also required.

There is no foreign language requirement for any graduate degree. Students can generally finish a master's degree in two years; a Ph.D. usually adds a minimum of two years beyond the master's level. The Graduate Record Examination (GRE) Aptitude Test scores are required with the application for admission.

Facilities and Special Resources

The Department actively draws upon the resources of many state, federal and international agencies unique to the Washington, D.C. area to offer experience from the world of government and business. The Library of Congress in Washington and the National Agricultural Library in Beltsville (just north of the campus) enhance teaching and research efforts.

Financial Assistance

Graduate assistantships are offered to qualified applicants on the basis of past academic performance, research potential and availability of funds. Many full-time students in the Department hold assistantships or some other form of financial aid. Part-time and summer work is often available for students who do not have assistantships. Also, a large number of graduate fellowships are available.

Additional Information

The ***Handbook of Policies for the Graduate Program*** provides course requirements, examination procedures and descriptive material for the M.S. and Ph.D. programs. For specific information contact:

Dr. Richard E. Just
Graduate Coordinator
Department of Agricultural and Resource Economics
University of Maryland
College Park, MD 20742
(301) 405-1291

For courses, see code AREC.

Agricultural Engineering Program (ENAG)

Associate Professor and Chair: Stewart

Professors: Johnson, Wheaton

Associate Professor: Grant, Ross

Assistant Professors: Magette, Shirmohammadi

Affiliate Assistant Professor: Brinsfield

The Department of Agricultural Engineering offers a graduate program of study with specialization in either agricultural or aquacultural engineering leading to the degree of Master of Science or Doctor of Philosophy. Courses and research problems emphasize the engineering aspects of the production, harvesting, processing and marketing of terrestrial and aquatic food and fiber products. Concern for the conservation of land and water resources and the utilization and/or disposal of byproducts associated with biological systems is included in order to maintain and enhance the quality of our environment while contributing to efficient production of food and fiber to meet increasing population demands.

Agricultural engineering graduate students can look forward to excellent employment opportunities. Recent estimates indicate three to five openings currently exist for every student completing an advanced degree in agriculturalengineering. Future projections indicate the demand for agricultural engineers with advanced degrees will be as good or better than it is now.

Admission and Degree Information

Admission is open to graduates in engineering, physical science or biological science who meet Graduate School requirements and who have satisfactorily completed a core of basic engineering courses. For the thesis M.S. program, aminimum of 30 semester credit hours are required, including at least nine hours of 600-level agricultural engineering courses, six hours of thesis research and three hours of biometrics. A non-thesis M.S. is also available requiring a minimum of 33 semester credit hours, which should include at least nine hours of 600-level ENAG courses, three hours for a required paper and three hours of biometrics.

A minimum of 60 credit hours beyond a B.S. are required for the Ph.D. program, including 12 hours of 600-level agricultural engineering courses, 12 hours of thesis research and three hours of biometrics. Additional courses may be required depending on the student's background.

The Department has no language requirements for either graduate degree. Except for the above requirements, a M.S. or Ph.D. program is planned on a personal basis and is oriented toward the intellectual and professional objectives of the student.

Facilities and Special Resources

In addition to well-equipped laboratories in the department, the facilities of the Agricultural Experiment Station, the Computer Science Center and the College of Engineering are available.

Financial Assistance

Financial assistance may be available to qualified candidates.

Additional Information

For additional information contact:

Dr. Fredrick Wheaton
Graduate Coordinator
Agricultural Engineering Department
University of Maryland
College Park, MD 20742
(301) 405-1198

For courses, see code ENAG.

Agronomy Program (AGRO)

Professor and Chair: Aycock

Professors: Bandel, Decker, Fanning, McKee, Mulchi

Associate Professors: Angle, Dernoeden, Glenn, Kenworthy, McIntosh, Rabenhorst, Ritter, Sammons, Turner, Vough, Weil, Weismiller

Assistant Professors: Carroll, Hill, James, Slaughter

The Department of Agronomy offers graduate study leading to the Master of Science and Doctor of Philosophy degrees. The student may concentrate in the Department's crops division or in the soils division. Programs are offered in cereal crop production, forage management, turf management, plant breeding, tobacco production, crop physiology, weed science, soil chemistry, soil physics, soil fertility, soil and water conservation, soil genesis and classification, soil survey and land use, soil mineralogy, soil biochemistry, soil microbiology, air pollution, waste disposal and soil environment interactions.

All graduates with advanced degrees in Agronomy from this University have found employment in areas of their interests. Most are teaching or conducting research at other universities or with the federal government; some are with international agencies and a few have advanced to administrative positions. A number are employed by industries in research or sales-related positions and some graduates are managing whole divisions of these corporations. Others are employed by consulting firms or are breeding new varieties of crops to sell to farmers. Opportunities for employment in the future appear to be excellent.

Admission and Degree Information

The master's program offers both a thesis and a non-thesis option. A bachelor's degree in agronomy is not required if the student has adequate training in the basic

sciences. All students must complete the Master of Science degree before admission to the doctoral program. Copies of Departmental regulations that have been assembled for the guidance of candidates for graduate degrees are available from the Department.

Facilities and Special Resources

The Agronomy Department has over 20 well-equipped laboratories to carry out basic and applied research in crop and soil science. Basic equipment in the laboratories includes: x-ray diffraction and mass spectrophotometer, atomic absorption gas chromatograph, isotope counters, petrographic scopes and equipment for thin section preparations, neutron soil moisture probe and scaler, tissue culture equipment, grain quality analyzer and carbon furnace. Growth chambers, extensive greenhouse space and five research farms and/or research and education centers permit a wide range of soil and environmental conditions for research into plant growth processes. A complete complement of planting and harvesting equipment is also available for field research. Students have access to a computer center located on campus, and microcomputers within the Department are also available. The University and the National Agricultural Sciences Libraries, supplemented by the Library of Congress, make the library resources among the best in the nation. Many of the Department's projects are conducted in cooperation with other departments on campus and with the headquarters of the Agricultural Research Service of the United States Department of Agriculture located three miles from campus.

Financial Assistance

A limited number of research assistantships and teaching assistantships are available for qualified applicants.

Additional Information

For more specific information on the program, contact:

Chair
Department of Agronomy
1109 H.J. Patterson Hall
University of Maryland
College Park, MD 20742
(301) 405-1306

For courses, see code AGRO.

American Studies (AMST)

Associate Professor and Chair: Kelly

Associate Chairman and Director of Graduate Studies: Caughey

Associate Professors: Caughey, Diner, Lounsbury, Mintz

Assistant Professor: Sies

Adjunct Professor: Washburn

American Studies offers an interdisciplinary program of study leading to the Master of Arts and the Doctor of Philosophy degrees. The Department is particularly oriented toward the study of 19th and 20th century American culture with special emphasis in the areas of popular culture, literature and society, women's studies, ethnography, material culture, film, art, and social and cultural change. By combining courses in American Studies with study in other departments and fields, students can tailor their

graduate program closely to their individual interests and career goals. Internship opportunities are available in area museums, archives, government agencies and local historical societies. Courses in material culture taught at the Smithsonian Institution and George Washington University are open to students in American Studies. The Department also cooperates with the Departments of History, Anthropology, Geography and Urban Studies, and the School of Architecture in sponsoring a certificate program in Historic Preservation. Students interested in that program are admitted to one of the cooperating departments and, upon successful application to the Committee on Historic Preservation, must then complete 24 additional credit hours in preservation-related courses.

Admission and Degree Information

Applicants to the program should have a broad liberal arts background appropriate to the interdisciplinary study of American culture at the graduate level.

The master's program requires completion of 30 credit hours. Students who elect to write a thesis take 24 hours of coursework and six hours of AMST 799 (thesis credit). To complete the non-thesis option, students must take 30 hours of coursework and submit a scholarly paper based on independent research in lieu of a thesis. In addition, all students must pass a written examination.

Ph.D. candidates must complete beyond the master's degree at least 30 credit hours, which are organized around an area of concentration. Students must also pass three written comprehensive examinations, and write and defend a dissertation based on original research.

Facilities and Special Resources

The Washington area offers extraordinary research facilities for the study of past and present American culture, including the Library of Congress, the National Archives, the National Museum of American History and the National Gallery, as well as numerous other museums, collections, archives and libraries. Through consortial arrangements with other schools in the area, including the George Washington University and Georgetown University, students may augment their programs with courses otherwise unavailable at the University of Maryland.

Financial Assistance

A limited number of teaching assistantships are available in addition to graduate fellowships. Students who hold assistantships typically teach two sections of AMST 201, Introduction to American Studies. Awards are generally made to students who have successfully completed one year in the graduate program.

Additional Information

Additional information on program offerings, degree requirements and financial aid can be obtained by writing to:

Director of Graduate Studies
Department of American Studies
University of Maryland
College Park, MD 20742
(301) 405-1354

For courses, see code AMST.

Animal Sciences Program (ADVP)

Professor and Program Chair: Vandersall

Professors: Westhoff (Department Chair), Mather, Vandersall, Vijay, Williams, (Animal Science); Mohanty (Associate Dean), Marquardt (Veterinary Medicine)

Professors Emeriti: Flyger, Keeney, King, Mattick

Associate Professors: DeBarthe, Douglass, Erdman, Hartsock, Majeskie, Peters, Russek-Cohen, Stricklin, Varner (Animal Sciences), Dutta, Mallinson, Snyder (Veterinary Medicine)

Affiliate Associate Professor: Stephenson (Veterinary Medicine)

Assistant Professors: Alston-Mills, Barao, Marshall, (Animal Sciences); Carmel, Ingling, Samal, Vakharia (Veterinary Medicine)

NOTE: Some courses in this program may require the use of animals. Please see the Statement on Animal Care and Use in the appendix and the policy statement for students under "Degree Requirements."

The Graduate Program in the Animal Sciences offers graduate study leading to the Master of Science and Doctor of Philosophy degrees. The master's degree program offers both the thesis and non-thesis options. Faculty research interests include animal nutrition, physiology, behavior, virology, immunology and cell biology. Opportunities for study are primarily related to domestic animals, but studies with other species are possible.

Admission and Degree Information

Applicants are required to submit Graduate Record Examination Aptitude Test scores and at least three letters of recommendation.

During the first semester, students should select a chairman for their Advisory Committee for program approval. With this Committee's advice, a proposed schedule of courses, including at least one credit of ADVP Seminar (ANSC 698A), must be filed. Committees may require remedial courses if students enter with inadequate prerequisites or deficiencies in undergraduate programs. By the third semester a thesis research or non-thesis scholarly paper must be approved and filed. The student must also present the thesis or scholarly paper in a public seminar and pass a final oral examination, which is given by the Advisory Committee, on the research. A written comprehensive examination is required of non-thesis students as well. A final bound copy of the thesis or scholarly paper must be submitted to the Program Office. Students with adequate undergraduate training usually complete the master's degree within two years.

Ph.D. students with master's degrees from other institutions are expected to meet the requirements indicated above. The M.S. is not a prerequisite but is advantageous for admission to Ph.D. program. Two additional credits of the program seminar are required. An Advisory Committee must be formed for program approval early in the program. A plan of study and research proposal must be filed as in the master's program. At least one semester of teaching experience is required. The Admission to Candidacy Examinations are both written and oral. Prior to the final oral examination, the candidate must present his/her dissertation in a public seminar. In addition to the dissertation, at least one paper in form for publication in a referred scientific journal must be approved. A final bound copy of the dissertation must be submitted to the Program Office. The Ph.D. degree should be completed within three years after the M.S. degree.

Facilities and Special Resources

The program's faculty represent research accomplished in a wide variety of related fields. Excellent supporting courses in physiology, biochemistry and microbiology are available in the appropriate departments. Courses in biometrics (BIOM) provide a strong background in experimental design and statistical analysis. Terminals and microcomputers are available in the Animal Sciences Center. The Computer Science Center offers extensive facilities for statistical analysis of thesis data.

Modern new laboratory facilities are available. The College of Veterinary Medicine moved to the new Gudelsky Center in 1989 and the Department of Animal Sciences is scheduled to move this year into an addition that will more than double the laboratory space in the Animal Sciences Center. Facilities are available for cell culture, monoclonal antibody production and enzyme-linked immunosorbant assays. Instrumentation is available to graduate students for gas liquid chromatography, amino acid analysis, atomic absorption, ultra violet and visible spectrophotometry, calorimetry, electron microscopy, liquid scintillation radioactivity measurements, electrophoresis, ultracentrifugation, ovum micromanipulation, a variety of microbiological, extensive recombinant DNA and an entire spectrum of biochemical techniques. Controlled environment facilities in the Center permit work with laboratory animals.

Herds of beef cattle, dairy cattle and swine are available for graduate research. While experiments with limited numbers of animals can be conducted on campus, those that require a large number of animals are carried out at one of three outlying farms. A cooperative agreement with the Agricultural Research Service at nearby Beltsville, Maryland (BARC) makes laboratory, animal and research personnel resources available for the graduate program.

In addition to excellent library facilities here, the National Agricultural Library, the National Library of Medicine and the Library of Congress constitute the best library resources for graduate study available anywhere and are all located within 10 miles of campus.

Financial Assistance

A number of graduate assistantships are available and awarded to students who present strong academic records and a capability and motivation to perform well in teaching or research assignments.

Additional Information

For specific information on the Program, admission procedures, or financial aid, contact:

Dr. J. H. Vandersall, Chair
Animal Sciences (ADVP) Graduate Committee
Department of Animal Sciences
University of Maryland
College Park, MD 20742
(301) 405-1391

For courses, see code ANSC.

Anthropology Program (ANTH)

Associate Professor and Chair: Whitehead

Professors: Agar, Chambers, Gonzalez, Williams

Associate Professor: Leone

Assistant Professors: Siedel, Stewart, Wali

Lecturers: Cassidy, Crane, Eidson, McDaniel

The Department of Anthropology offers graduate study leading to a Master of Applied Anthropology (MAA) degree. This is a new professional program for students interested in an anthropology career outside academia. Core courses include preparation in cultural analysis and management. Students intern with an agency or organization suitable to their career interests. Specialization is flexible, permitting students to select from a variety of areas of career focus or to tailor course requirements to their special career requirements.

Admission and Degree Requirements

Students are required to submit Graduate Record Examination scores and fulfill the Graduate School admission requirements. The program requires 42 credit hours of coursework. All students must complete an internship. There is no thesis requirement.

Facilities and Special Resources

A Departmental computer lab, three teaching and research labs for physical anthropology and archeology, and a photographic darkroom are available for student use.

Financial Assistance

A limited number of teaching assistantships are available to qualified graduate students. Part-time employment related to Department research is occasionally available.

Additional Information

For additional information please contact:

Dr. Erve Chambers, Graduate Director
Department of Anthropology
University of Maryland
College Park, MD 20742
(301) 405-1423

For courses, see code ANTH

Applied Mathematics Program (MAPL)

Professor and Director: J. Cooper (MATH) ANSC:

Associate Professor: Russek-Cohen BMGT:

Professors: Assad, Ball, Boden, Gass, Golden, Katz; ***Associate Professors:*** Alt, Fromovitz, Widhelm CMSC: ***Professors:*** Agrawala, Basili, Edmundson, Kanal, Minker, O'Leary, Stewart; ***Associate Professor:*** Reggia; ***Assistant Professors:*** Elman, Gasarch, Stotts ECON: ***Professors:*** Almon, Betancourt, Kelejian; ***Associate Professors:*** Coughlin, Prucha ENAE: ***Professors:*** Donaldson, Lee; ***Associate Professor:*** Jones ENCE: ***Professor:*** Sternberg; ***Associate Professors:*** Garber, Schwartz ENCH: ***Professors:*** Cadman, Gentry, McAvoy; ***Associate Professor:*** Calabrese; ***Assistant Professor:*** Zafiriou ENEE: ***Professors:*** Baras, Blankenship, DeClaris, Davisson, Ephremides, Harger, Krishnaprasad, Mayergoyz, Newcomb, Ott, Taylor; ***Associate Professors:*** Makowski, Narayan, Shayman, Tits, Tretter ENME: ***Professors:*** Marks, Yang; ***Associate Professors:*** Bernard, Shih, Walston IPST: ***Research Professor:*** Babuska; ***Professors:*** Dorfman, Hubbard,

Kellogg, Olver, Yorke MATH: ***Professors:*** Alexander, Antman, Benedetto, Berenstein, Cooper, Evans, Fitzpatrick, Freidlin, Greenberg, Hummel, Johnson, Kueker, Liu, Osborn, Sweet, Wolfe; ***Associate Professors:*** Glaz, Green, Jones, Maddocks, Sather, Schneider, Vogelius METO: ***Professors:*** Baer, Vernekar; ***Associate Professor:*** Robock; ***Assistant Professor:*** Carton PHYS: ***Professors:*** Banerjee, Brill, Das Sarma, Dragt, Einstein, Ferrell, Glick, Gluckstern, Greenberg, Griffin, Hu, Korenman, MacDonald, Misner, Prange, Redish, Sucher, Wallace, Woo; ***Associate Professors:*** Fivel, Gates, Hassam, Kim, Wang PUAF: ***Professor:*** Young STAT: ***Professors:*** Mikulski, Yang; ***Associate Professors:*** Kedem, Slud, Smith

The interdisciplinary Applied Mathematics Program, which is affiliated with the Department of Mathematics, offers graduate study leading to the Master of Arts and Doctor of Philosophy degrees. These are awarded for graduate study and research in mathematics and its applications in the engineering, physical and social sciences. In addition, the Applied Mathematics Program offers certified minors in applied mathematics for graduate students not enrolled in the Program.

The Department of Mathematics assumes the responsibility for the administration of the applied mathematics courses under the MAPL label. The Graduate Office of the Department also maintains the records of all students in the Applied Mathematics Program and handles correspondence with those applying for admission. However, it is important that any application for admission indicates clearly whether a student wishes to enter the Mathematics (MATH) or the Applied Mathematics (MAPL) Program.

The Applied Mathematics Program trains individuals who are able to enhance their understanding of a wide spectrum of scientific phenomena through the application of rigorous mathematical analysis. At least half of the required work is expected to be in courses with primarily mathematical content; the remaining courses must apply to a field outside of the usual mathematics curriculum. Graduate students currently pursue various areas of physics, information structures, meteorology, operations research, pattern recognition, structural mechanics, and systems and control theory. Many other areas of study are available through the participating departments. All students must include courses on numerical and scientific computing in their programs; the faculty includes a strong group of specialists in numerical analysis.

Admission and Degree Information

In addition to the Graduate School requirements, applicants with at least a B average (3.0 on a 4.0 scale) should have completed an undergraduate program of study that includes a strong emphasis on rigorous mathematics, preferably through the level of advanced calculus and abstract algebra. Admission will be based on the applicant's capability to do graduate work in mathematics as demonstrated by the letters of recommendation, grades in coursework and program of study. In some circumstances, a provisional admission may be given to applicants whose mathematical training is not sufficiently advanced. Previous education in an application area, such as physics, one of the engineering disciplines or economics, and a basic competence in computational techniques will be favorably considered in a student's application, although this is not a prerequisite.

When a student has decided upon an area of specialization, an advisory committee is appointed by the Program Director. This committee is responsible for formulating

with the student a course of study that leads toward the degree sought. This course of study must constitute a unified, coherent program in an acceptable field of specialization of applied mathematics and must meet with the approval of the Graduate Committee for Applied Mathematics.

In addition to the Graduate School requirements, the Applied Mathematics Program has the following degree requirements.

For the master's degree, the Program offers a thesis and non-thesis option. In the thesis option, 24 credits of coursework are required with at least six more credits of thesis work. In the non-thesis option, 30 credits of coursework are required, and the student must pass a set of comprehensive examinations at the master's degree level. A scholarly paper is also required. In both options, the student must participate at least one semester in the Applied Mathematics Seminar.

For the Ph.D. degree, the student must take 36 credits of coursework and pass a set of comprehensive written examinations at the Ph.D. level. In addition, the student must pass the Oral Candidacy Examination, which tests the student on advanced material to determine if he or she is prepared to do the research for a doctoral dissertation. At least 12 credits of dissertation work are required. The doctoral student must also participate at least two semesters in the Applied Mathematics Seminar.

All M.A. and Ph.D. students must take at least one semester of numerical analysis. Details on the level and distribution of coursework and examinations in mathematics and in the applications area are given in the policy brochure of the Applied Mathematics Program available at the Applied Mathematics Office.

Certified Minors

The Applied Mathematics Program offers certified minors in applied mathematics to graduate students who are enrolled in other graduate degree programs at the University of Maryland. The successful completion of the requirements for such a minor will be recorded in the student's transcripts. A number of departments participating in the Applied Mathematics Program also permit the requirements of the certified minor to replace part of the degree requirements of the major department.

A student who wishes to pursue a certified minor in applied mathematics must fill out an application form for participation in the Certified Minor Program. Such forms are available from the Office of the Director of the Applied Mathematics Program.

Details on course requirements are contained in the policy brochure of the Applied Mathematics Program.

Financial Assistance

The Program offers teaching assistantships as the main source of support for graduate students in the Department of Mathematics. These assistantships carry a stipend plus remission of tuition of up to 10 hours each semester. Some research assistantships are also available through participating departments once a student has acquired advanced training.

Additional Information

For more specific information, contact:

Director
Applied Mathematics Program

1104 Mathematics Building
University of Maryland
College Park, MD 20742
(301) 405-5062

For courses, see code MAPL.

Architecture Program (ARCH)

Professor and Acting Dean: Hill

Graduate Director: Sachs

Assistant to the Dean: Lapanne

Professors: Bennett, Etlin, Hill, Lewis, Loss, Lu, Schlesinger, Steffian

Associate Professors: Bechhoefer, DuPuy, Fogle, Schumacher, Vann

Assistant Professors: Bell, Drost, Kelly, Masters, Thiratrakoolchai, Weiss

Lecturers: Dynerman, McInturff, O'Meara, Wiedemann

Instructor: Gardner

The School of Architecture offers a graduate program leading to the Master of Architecture degree. The School's objective is to provide the highest possible quality professional education and training in architecture. Its program is organized around required courses in architectural and urban design, architectural history and theory, and architectural science and technology. Electives in architecture and related fields are available in a curriculum that is rigorous and challenging. The School is accredited by the National Architectural Accreditation Board and is a member of the Association of Collegiate Schools of Architecture assigned to the Northeastern Region.

Admission and Degree Information

Admission to the graduate program is competitive. In addition to the Graduate School requirements, candidates must submit the following: 1) three letters of recommendation from persons competent to judge the applicant's probable success in graduate architectural school; 2) the Graduate Record Examination aptitude test results (not over five years old); and 3) evidence of creative ability in the form of a portfolio of drawings, photographs or other expressive media—details concerning format and content may be obtained from the School of Architecture.

Three categories of students will be considered for admission: 1) students with a four-year bachelor's degree (architecture or equivalent major) from accredited architecture schools; 2) students who do not have a bachelor's degree in architecture from an accredited college or university but have successfully completed specified undergraduate prerequisites that are outlined by the School of Architecture; and 3) students with an accredited professional bachelor's or master's degree in architecture. Students are expected to enroll on a full-time basis. For complete information on curricula requirements for these categories, write to the School of Architecture.

1. Students entering the program with a four-year bachelor's degree in architecture from an accredited college or university normally need two years of graduate study to complete the requirements for the professional degree Master of Architecture. The established curriculum requires four semesters of academic work encompassing a total of 60 credits. Additional credits may be required depending upon the admissions committee's evaluation of the individual's academic and architectural experience.

2. Students who enter the professional program without an architecture bachelor's degree will normally require seven semesters of design studio and other prerequisite courses. Students may be granted advanced standing if they have completed the appropriate prerequisites. Information on required courses and curriculum may be obtained from the School of Architecture.
3. A special option leading to the Master of Architecture degree is available for those students who already possess a professional degree in architecture (B.Arch. or M.Arch.) from an accredited program. This option is designed to accommodate the needs of students who wish to do advanced work beyond that required for the professional degree. Applicants must specify in detail the nature of the proposed course of study for review and approval by the admissions committee prior to their admission. The School currently provides resources for advanced work in international studies in architecture, architectural history and preservation, and architectural technology.
4. A program leading to a Master's Certificate in Historic Preservation is available to M.Arch. candidates. The course of study includes 24 credits and an approved thesis, which may satisfy requirements of both the Architecture and Preservation curricula.

Facilities and Special Resources

The School of Architecture is ideally located between Washington, D.C. and Baltimore and surrounded by a number of historic communities and a varied physical environment. The resulting opportunity for environmental design study is unsurpassed. The School's resources include a modern physical plant that provides design workstations for each student, a wood-working and model shop, an environmental testing laboratory, a computer-aided design facility and a darkroom. The School's library contains some 26,000 volumes and 6,000 current periodicals, making it one of the major architectural libraries in the nation. The National Trust Library for Historic Preservation, housed in the School, contains 11,000 volumes and 450 periodical titles. The slide collection numbers some 240,000 slides on architecture, landscape architecture, planning and technical subjects. The School also provides an opportunity for professional experience and service through its nonprofit Center for Architectural Design and Research and CADRE Corporation, whose mission is to broaden the educational experience of students through environmental design services directed by faculty members and rendered to a variety of clients.

Students continue to participate in field archaeology. Projects in the past have taken place in Tunisia, Turkey, Jordan, Israel and Sri Lanka. The School is a sponsoring member of CAHEP (Caesarea Ancient Harbor Excavation Project) now in its eleventh year. Qualified students participate in both land and underwater archaeology.

Summer workshops for historic preservation are sponsored by the School in Cape May, NJ, a designated national historic landmark district, and Kiplin Hall, North Yorkshire, England. Students may earn credit doing hands-on restoration work and by attending lectures presented by visiting architects, preservationists and scholars.

Financial Assistance

The School of Architecture offers a limited and varying number of teaching and research assistantships, scholarships, fellowships and internships. Applicants should apply for financial assistance when submitting the application for admission.

Additional Information

For more specific information on the program, contact:

Graduate Director
Architecture Program
School of Architecture
University of Maryland
College Park, MD 20742
(301) 405-6284

For courses, see code ARCH.

Art History Program (ARTH)

Professors: Burnham, Denny, Driskell, Eyo, Farquhar, Miller, Rearick, Wheelock

Associate Professors: Hargrove, Pressly, Spiro, Venit, Withers

Assistant Professors: Colantuono, Kuo, Sandler

Visiting Professor: Daniel Lettieri, C. Douglas Lewis (Fall), Marianna Schreve Simpson (Spring)

The Department of Art History offers graduate study leading to the Master of Arts and Doctor of Philosophy degrees. The Program is committed to the advanced study and scholarly interpretation of works of art from the prehistoric era to the present and is grounded in the concept of art as a humanistic experience. The faculty offer expertise in all phases of the history of Western art as well as the arts of Africa, Pre-Columbian America and East Asia.

Admission and Degree Information

For admission to the master's program, students should have an undergraduate degree from an accredited college or university, or its equivalent. Although the applicant must demonstrate a general knowledge of art history, an undergraduate major in art history is not required. Students are required to submit the verbal and quantitative Graduate Record Examination scores for admission.

For the master's degree, the student will: complete 30 credit hours at the 600 level, including ARTH 692, Methods of Art History; maintain a grade of B or better in coursework; pass the departmental language examination in either French, German or a language appropriate to the area studied, such as Japanese; complete a thesis that demonstrates competency in research and in original investigation; and pass a final oral examination on the thesis and the field that it represents.

Requirements for the Doctor of Philosophy degree include 30 credit hours of courses taken at the 600 level or above with a grade of B or better; ARTH 692, Methods of Art History, if not previously taken; reading knowledge of both French and German or other languages appropriate to the area studied; oral and written qualifying examinations in the student's major and minor fields; a dissertation that demonstrates the student's capacity to perform independent research; and a final oral examination on the dissertation and the field it represents.

All applicants are encouraged, and those seeking financial assistance are required, to submit their applications by February 1 for entrance in the fall term. For admission in the spring, applications must be completed by November 1.

Facilities and Special Resources

The Art Library houses approximately 70,000 volumes as well as a vast body of auxiliary material, including about a million sheets of microfiche. The Department's

visual aids facility contains an impressive 175,000 slides and a constantly growing battery of video technology. The Art Gallery, which is also located in the Art/Sociology Building, maintains a lively and varied exhibition schedule and has a permanent collection of twentieth-century American paintings and prints and a study collection of African art. Graduate courses in museum studies are offered through the Gallery. For hands-on study of archaeological artifacts, the Department has the Lloyd and Jeanne Raport collection of some 130 objects from ancient Egypt, Greece, Rome and Pre-Columbian America.

At the University of Maryland Caesarea Project, which is an ongoing archaeological project at Caesarea Maritima, Israel, qualified graduate students may take part in the excavations, and work at this site may lead to M.A. or Ph.D. dissertations. Students may also be eligible to participate in the archaeological fieldwork of Professor Eyo in Nigeria or Professor Miller at ancient Mexican sites.

The University of Maryland is located in the suburbs of Washington, D.C. and is 30 minutes from the National Gallery of Art and the National Gallery's Center for Advanced Study in the VIsual Arts, the Corcoran Gallery, the Phillips Collection, the Hirshhorn Museum and Sculpture Garden, the National Museum of American Art, the Museum of African Art, the Freer and Arthur M. Sackler Galleries, which are devoted to the art of East Asia, the National Museum of Women in the Arts and many other major art museums. The campus is a 50-minute drive from such Baltimore institutions as the Walters Art Gallery and the Baltimore Museum of Art. In addition to the University's library resources, graduate students have access to the Library of Congress, the Archives of American Art, the libraries of Dumbarton Oaks and other research facilities. In order to enhance the student's curricular choices, the Department maintains an arrangement for course exchange with the Art History department of the Johns Hopkins University in Baltimore. To similar effect, the Department is a member of the Washington Area Art History Consortium, which unites the graduate art history departments of the greater Washington area.

The Department organizes a variety of liaison activities with leading cultural institutions in the Washington-Baltimore area. The Middle Atlantic Symposium in the History of Art is sponsored jointly by the Department and the National Gallery of Art; this annual event provides the opportunity for advanced graduate students from universities in the Middle Atlantic region to present their research at a professional forum. Special seminars are frequently given by curators of such local collections as the National Gallery of Art, the Freer Gallery or the Department of Prints and Photographs at the Library of Congress. A program has been initiated whereby a Senior Fellow at the Center for Advanced Study in the Visual Arts (CASVA) will give two graduate courses in the Department. In a related program, CASVA Fellows will meet with our students for informal colloquia. Plans are now formed for an annual meeting, sponsored jointly by the Department and CASVA, that will bring together senior scholars from both institutions plus guest speakers, the papers to be published by CASVA.

Financial Assistance

Fellowships are awarded strictly on the basis of merit by the College of Arts and Humanities and by the Graduate School. Several graduate assistantships are awarded by the Department. Also, four Museum Fellowships are awarded each semester by the Department of Art History for research at major museums in the Washington-Baltimore area, and one Museum Fellowship is awarded for research in Europe. The Department's

Frank Di Federico Fellowship, in memory of the late Professor Di Federico, is for work on the doctoral dissertation. In honor of its former chairman, the Department has established the George Levitine Art History Endowment, in support of research activities of graduate students as well as faculty.

Additional Information

A more detailed description of Departmental requirements for the above programs and other information may be obtained from:

Graduate Secretary
Department of Art History
University of Maryland
College Park, MD 20742
(301) 405-1479

For information on the Master of Education in Art Education, refer to the section of this catalog devoted to Secondary Education. For courses, see code ARTH.

Art (ARTT)

Professor and Chairman: Morrison

Professors: DeMonte, Driskell, Lapinski, Morrison, Truitt

Associate Professors: Craig, Forbes, Gelman, Kehoe, Klank, Krushenick, Niese, Pogue, Richardson

Assistant Professors: Blotner, Humphrey, Ruppert

The Department of Art offers a program of graduate study leading to the degree of Master of Fine Arts. The Art Department's Graduate Faculty consists of over 17 active professional artists specializing in the traditional studio areas of painting, sculpture, printmaking, drawing and photography. Additional interests are reflected in course offerings such as papermaking, environmental art and mixed media.

Studio facilities are spacious and well-equipped. Painting students are able to work in oils, acrylic, watercolor, fresco and encaustic. An annual methods and materials course is of special interest. The sculpture area includes a woodshop, foundry, shops for welding, forging, stone and wood carving, and an environmental sculpture space. Printmakers can choose to work with intaglio, lithography, photo-etching, silkscreen or woodcuts. Drawing and papermaking facilities are also available as well as special project rooms. There is a complete darkroom for photography students.

Each graduate student is provided with a studio and access to models and classroom facilities. Environmental works and sculptural installations may be built both indoors and outside on the grounds.

There are two galleries and two libraries within the Art Department's building. The University of Maryland Art Gallery features national and international exhibitions as well as faculty and MFA thesis shows. The West Gallery provides student-organized exhibitions by and for undergraduate students and a space for social activities for both students and faculty members. The Art Library, which is shared by the Art and Art History Departments, provides both visual and literary reference volumes in addition to films and videos. The slide library boasts a growing collection of reproductions of artworks from significant art movements.

Admission and Degree Information

The Art Department requires an undergraduate degree with an art major from an accredited college or university or its equivalent for admission to the graduate program. The candidate should have a minimum of 30 credit hours of undergraduate work in studio courses and 12 credit hours in art history courses. Undergraduate work should also include other humanities area courses. Special Departmental requirements must also be met. Candidates for the Master of Fine Arts degree will be required to present an exhibition of their thesis work, write an abstract based on the thesis and present an oral defense of the thesis.

Financial Assistance

The Department offers seven teaching assistantships and the College offers two- year fellowships. A number of Graduate School fellowships are also available. Applicants should submit their applications by February 1 for consideration for a graduate assistantship or fellowship.

Additional Information

For further information, contact:

The Art Department
University of Maryland
College Park, MD 20742
(301) 405-1442

For courses, see code ARTT.

Astronomy Program (ASTR)

Professor and Director: Bell

Professors: A'Hearn, Blitz, Erickson (Emeritus), Harrington, Heckmann, Kerr (Emeritus), Kundu, Papadopoulos, Rose, Trimble, Wentzel, Wilson

Adjunct Professors: Hauser, Holt, Westerhout

Associate Professors: Eichler, Matthews, Vogel, Zipoy

Assistant Professor: Mundy

The Department of Astronomy offers programs of study leading to the Master of Science and Doctor of Philosophy degrees. The M.S. program includes both a thesis and non-thesis option.

A full schedule of courses in all fields of astronomy is offered including galactic astronomy, general astrophysics, solar system astrophysics, observational astronomy, celestial mechanics, solar physics, study of the interstellar medium, extragalactic astronomy and plasma astrophysics. Some areas in which the faculty focus their research efforts are stellar atmospheres and spectra, comets, solar radio astronomy, the interstellar medium, active galaxies and plasma astrophysics.

Admission and Degree Information

No formal undergraduate course work in astronomy is required. However, an entering student should have a basic, working knowledge of the subject, which could be obtained from one of many elementary textbooks. A more advanced knowledge will of course enable a student to progress more rapidly during the first year of graduate work.

A satisfactory score on the GRE Advanced Test in Physics is required before an applicant's admission to the Graduate School will be considered, but the Graduate Entrance Committee may waive this requirement in special cases. Instead, the committee may set other conditions as a requirement for admission to be fulfilled either before admission or during the first year at Maryland.

During the first two years of the Ph.D. program, full-time students must take at least four and normally will take all of the principal courses: ASTR 600, 605, 610, 620, 640 and 670 plus the required courses in physics. Students will be aided at the end of the first year in choosing a suitable research project that is required during the second year. Students may qualify for the Ph.D. program based on their coursework and research project performance and on a written examination integrating the six principal courses. The examination is taken during the summer after the second year.

Course requirements for the Ph.D. include the principal courses, at least two additional advanced astronomy courses and twelve credits of advanced physics. In addition, students must acquire some personal experience with modern observational methods and analysis, normally by accompanying a faculty member to a suitable observatory. All of the principal courses are required before advancement to candidacy.

Candidates for the Master of Science Degree with thesis are required to complete 24 credits exclusive of registration for master's research. At least 12 of these credits must be in the major area and at least 12 must be at the 600 level (not necessarily the same 12). In addition, at least six credits must be in a related field (supporting area).

The non-thesis option of M.S. degree requires six credits in the major at the 600 level in addition to the general requirements described above. That is, a total of 30 credits are required of which 18 must be in the major and at least 18 at the 600 level. The student must also pass a written examination, usually consisting of the written part of the Ph.D. qualifying Examination with appropriately chosen passing requirements.

Facilities and Special Resources

The Astronomy Program carries on an extensive research program in the areas discussed above with the graduate students playing an active role in this research. Approximately one-fourth of all research papers published have a graduate student as one of the authors.

The Program has strong interaction with national astronomy observatories, where many students and faculty maintain observing programs, and also with neighboring scientific institutes. A major program of cooperative research has been established with the Goddard Space Flight Center, where a number of graduate students conduct research. There are also contacts with the Naval Observatory, the Naval Research Lab and other government agencies.

The University of Maryland has recently joined with the University of California at Berkeley and the University of Illinois in a project to expand and upgrade the radio observatory located at Hat Creek in California. When the initial stages of the project are completed in a few years, the new array will be the largest such instrument operating at mm wavelengths. This will be a major tool for the exploration of the interstellar medium. When the system is fully operational, it will be possible to do remote observing from the Maryland site. Data reduction will be possible "in house" because of a major expansion in the computer facilities in the Astronomy Program.

Financial Assistance

The Astronomy Program offers both teaching and research assistantships. In 1989-90 there were 16 teaching assistants and 10 research assistants. Most students receive assistantships to cover the summer period. These are either with faculty in the Program or with staff members at the Goddard Space Flight Center. Some summer teaching assistantships are also available.

The deadline for financial support applications is February 1 for assistantships and fellowships.

Additional Information

For more specific information, contact:

Director
Astronomy Program
1207 Computer and Space Sciences Building
University of Maryland
College Park, MD 20742
(301) 405-3001

For courses, see code ASTR.

Biochemistry Program (BCHM)

Professors: Armstrong, Dunaway-Mariano, Gerlt, Hansen, Munn, Ponnamperuma

Professors Emeriti: Holmland, Keeney, Veitch

Associate Professor: Sampugna

Assistant Professor: Julin

The Graduate Program in Biochemistry is the College Park component of the University of Maryland Graduate Program in Biochemistry, which also has components at the University of Maryland Baltimore County and at the University of Maryland Medical School and Dental School in Baltimore. The Program offers study leading to Master of Science and Doctor of Philosophy degrees. Research specialization at College Park is available in drug metabolism, enzyme mechanisms, bioorganic chemistry, lipid biochemistry, membrane structure and function, metabolic regulation, nucleic acid biochemistry, nutritional biochemistry and x-ray crystallography.

Admission and Degree Information

The M.S. degree program offers both the thesis and non-thesis options. Applicants should have completed an undergraduate program of study with strong emphasis on chemistry and/or biology and appropriate supporting courses in mathematics and physics. Before obtaining a degree in the program, a student must demonstrate adequate preparation in biochemistry and in analytical, organic and physical chemistry. Diagnostic examinations in these subjects are offered to students at the beginning of their first semester for this purpose. Students who perform unsatisfactorily on these examinations or who may not have had undergraduate preparation in one or more of these areas will be advised to register for appropriate courses. Information on coursework, comprehensive examinations and the research interests of the faculty is available for the guidance of degree candidates.

Facilities and Special Resources

Biochemistry research is conducted in a new wing occupied in 1975. In addition to well-equipped research laboratories, the following central facilities are available: animal colony, fermentation pilot plant, analytical ultracentrifuge, PDP-11 and VAX computers, a computer graphics facility, liquid scintillation counters, nuclear magnetic resonance and mass spectrometers, and a chemistry- biochemistry library.

Financial Assistance

Entering graduate students are normally supported on graduate teaching assistantships. Teaching assistants usually instruct undergraduate laboratory and recitation classes and receive in return a tuition waiver for a 10-credit program of graduate study each semester.

Additional Information

Information on requirements and research interests of the faculty may be obtained from:

Director of Graduate Studies
Department of Chemistry and Biochemistry
University of Maryland
College Park, MD 20742
(301) 405-1796

For courses, see BCHM.

Botany Program (BOTN)

Professor and Acting Chair: Teramura

Distinguished Professor: Diener

Professors: Bean, Corbett, Gantt, Kantzes, Kennedy[1], Krusberg, Kung, Lockard[2], Patterson, Reveal, Sisler

Associate Professors: Barnett, Bottino, Cooke, Forseth, Grybauskas, Motta, Racusen, Steiner, Sze, Wolniak

Assistant Professors: Dudash, Fenster, Hutcheson, Straney, Van Valkenburg, Watson

Adjunct Associate Professor: Cohen

Affiliated Associate Professor: Inouye

[1]Joint appointment with Horticulture
[2]Joint appointment with Secondary Education

The Department of Botany offers graduate programs leading to the Master of Science and Doctor of Philosophy degrees. In consultation with faculty advisers, students develop course programs and research problems according to their individual intellectual and professional needs. The program's objective is to equip the student with the background and techniques for a career in plant biology in academic, governmental, industrial or private laboratories.

Areas of specialization in plant biology include biochemistry, cell biology, developmental biology, ecology, evolution, genetics and molecular biology, host- pathogen interactions, mycology, nematology, pathology, phycology, physiology, systematics and virology.

A wide range of job opportunities are available for M.S. and Ph.D. degree holders in botany. A high percentage of our graduates currently find appropriate positions within a short time of graduation.

Admission and Degree Information

There are no special admission requirements. A high degree of intellectual excellence is of greater consequence than the completion of a particular curriculum at the undergraduate level. While the degree requirements are flexible, they involve a demonstration of competence in the broad field of botany, as well as the completion of courses in other disciplines that support modern competence in this field. A foreign language is required only if it is deemed essential by the student's advisory committee.

Facilities and Special Resources

The Department's laboratories are equipped to investigate most phases of botanical and molecular biological research. Field and greenhouse facilities are available for research. Major pieces of laboratory equipment include transmission and scanning electron microscopes, ultracentrifuges, liquid chromatographs, mass spectrometers, low-speed centrifuges, ultramicrotomes, infra-red spectrophotometers, recording spectrophotometers, gas chromatographs and environmentally controlled growth chambers. Special facilities available for research include: a herbarium, biochemistry preparation rooms, dark rooms, cold rooms and special culture facilities for algae, fungi and higher plants.

Financial Assistance

Financial assistance is available in the form of competitive fellowships and graduate assistantships for teaching and research.

Additional Information

The Department has a special brochure available upon request. For specific information on Departmental programs, admission procedures or financial aid contact:

Chair
Department of Botany
University of Maryland
College Park, MD 20742
(301) 405-1649

For courses, see code BOTN.

Business and Management Program (BMGT)

Dean: Lamone

Associate Dean: Leete

Assistant Deans: Kelly, Mattingly, Stocker

Director of Doctoral Program: Sims

Director of MBA & MS Programs: Waikart

Assistant Director of MBA & MS Programs: Walsh

Chairpersons: Kolodny, Loeb, Golden, Durand, Locke, Corsi, Hevner

Professors Emeriti: Taff, Wright

Professors: Assad, Ball, Bartol, Bodin, Bradford, Carroll, Chen, Durand, Gannon, Gass, Golden, Gordon, Greer, Haslem, Jolson, Kolodny, Kotz, Lamone, Leete, Levine, Locke, S. Loeb, Masi (Affiliated), Preston, Senbet, Simon, Sims, Yao

Associate Professors: Alavi, Alt, Bedingfield, Biehal, Chang, Corsi, Courtright (Ret), Edelson, Eun, Fromovitz, Grimm, Gupta, Hevner, Krapfel, M. Loeb, Nickels, Olian, Poist, Smith, Taylor, Widhelm

Assistant Professors: Ali, Basu, Calfee, Dresner, Fu, Grimshaw, Jang, KaKu, LeClere, Mattingly (Affiliated), Raschid, Scheraga, Schick, Scott, Seshadri, Soubra, Stephens, Stockdale, Unal, Windle

The College of Business and Management offers graduate study leading to the degrees of Master of Business Administration (MBA), Master of Science in Business and Management (M.S.), and Doctor of Philosophy (Ph.D.). The College's MBA program is accredited nationally by the American Assembly of Collegiate Schools of Business. Only about 30 percent of the more than 1,000 graduate programs in the country are accredited by the AACSB, a reflection of the quality of faculty, students, curriculum, and facilities.

Areas of faculty specialization include accounting, entrepreneurship, finance, management science and statistics, information systems, international business, marketing, management and organization, transportation, and business and public policy.

Admission and Degree Information

Admission criteria for the MBA, M.S. and Ph.D. programs are based on: (1) quality of undergraduate and graduate coursework; (2) score on the Graduate Management Admission Test (GMAT); (3) letters of recommendation; (4) other relevant information and professional experience; and (5) written essays of objectives. Prospective applicants should contact the program at (301) 405-2278 for master's degree application materials and (301) 405-2213 for the Ph.D. program.

MBA Program The College of Business and Management offers an MBA program designed to provide the educational foundation for those students with the potential to exhibit the highest degree of excellence in future careers as professional managers. The MBA program requires 54 credits of coursework (18 courses of which five are electives), which is normally four semesters for a full-time student. There is no thesis requirement. Successful students in the program are expected to demonstrate the following: (1) a thorough and integrated knowledge of the basic tools, concepts and theories relating to professional management; (2) behavioral and analytical skills necessary to deal creatively and effectively with organizations and management problems; (3) an understanding of the economic, political, technological and social environments in which organizations operate; (4) a sense of professional and personal integrity and social responsibility in the conduct of managerial affairs both internal and external to the organization.

Program prerequisites include a bachelor's degree, successful completion of a college-level calculus course and facility with the microcomputer.

About one-half of the students enrolled are full-time; these students take 15 credits during each semester of the first year and 12 credits each semester of their second year. Part-time students take six credits each regular semester and during the summer. Most courses for part-time students are at night. Students whose cumulative grade point average falls below 3.0 will be placed on probation and will be given a specified amount of time to raise the average to a 3.0. Failure to do so will result in academic dismissal from the program.

Maryland MBA graduates obtain employment in a wide spectrum of organizations. Starting salaries typically range from $30,000 to $60,000 per year.

M.S. Program The College offers an M.S. program for students wishing to concentrate in Accounting/Information Systems, Information Systems, Operations Research or Statistics. The Program is designed for students with strong quantitative skills who desire a more technical management education. Students typically come to the program with undergraduate majors in business, engineering, sciences, information and computer systems, mathematics or economics. Prerequisites include calculus and a high-level computer language. Additional prerequisites in business and management fundamental courses are determined by the student's background. Depending on the concentration selected, the program calls for either 30 or 33 credit hours beyond the prerequisites. A thesis option is offered that may represent six credits in the area of concentration. Program progress and admission standards described above for the MBA program are also applicable to the M.S. program.

Ph.D. Program The Ph.D. program is designed to produce outstanding scholars in management-related disciplines. Thus, a strong research philosophy pervades the entire program. Only full-time students are admitted. The low student-to- faculty ratio fosters a high degree of interaction between faculty and students on research projects of mutual interest, frequently culminating in journal articles. Students whose career aspirations are congruent with the program's research orientation can look forward to a learning experience that is not only demanding but also stimulating and enriching. Recent graduates are employed at the following academic institutions: Boston College, Columbia University, Georgia Tech, Houston, Penn State, Syracuse, Texas A & M, Vanderbilt University, the University of Texas and the University of Washington.

All Ph.D. students are provisionally admitted and must achieve a 3.25 GPA in each of their first two semesters. Failure to do so results in being placed on probation for one semester. The student will then be dismissed unless a 3.25 overall GPA is obtained.

Ph.D. course requirements depend on the amount of relevant prior study. Preparation in calculus is required for admission.

The Ph.D. student may select a single major (18 credits), one minor (12 credits) and a set of research tools courses (12 credits). Major areas of concentration may be chosen from among such fields as accounting, finance, human resource management and labor relations, information systems, management science and statistics, marketing, organizational behavior, management strategy and policy, and transportation and physical distribution.

Minors and second majors may include areas inside or outside the College of Business and Management. Typical outside minors include computer science, economics, engineering, government and politics, mathematics, psychology and sociology.

Students are required to take written comprehensive examinations in the major area and the minor or research tools subject area. After all coursework and written exams have been successfully completed, each student must pass a comprehensive oral examination. Having passed the oral exam, the student is advanced to candidacy.

Each Ph.D. candidate prepares a formal dissertation proposal and defends it at an open meeting of faculty and students. The proposal should clearly indicate how the

dissertation will make a contribution to the literature of the field. Every doctoral student must register for a minimum of 12 dissertation research credits during the program.

MBA/JD Joint Program

The College of Business and Management and the School of Law of the University of Maryland at Baltimore offer a joint program of studies leading to MBA and JD degrees. Under the terms of the joint program, a student may earn both degrees in four academic years. The accelerated program is possible because some courses can be credited toward both degrees. Candidates must apply for admission to the Law School at Baltimore as well as to the Graduate School at College Park and must be admitted to both programs.

Under the joint program 75 credits in law school coupled with 39 credits in business courses are required for graduation. Fifteen credits of law will be substituted for MBA elective coursework. Grade point averages in each program will be computed separately and students must maintain minimum standards in each school to continue in the program. The Graduate School will not accept transfer credit from coursework taken outside the joint program. A student must complete both programs satisfactorily in order to receive both degrees. The MBA and the JD degrees must be awarded simultaneously. A student whose enrollment in either program is terminated may elect to complete work for the degree in which he or she remains enrolled, but such completion must be upon the same conditions as required of regular (nonjoint program) degree candidates. Student programs must be approved by the law school adviser for the joint program and the MBA Program Director. For further discussion of admission and degree requirements, students should see the above and consult the entry in the University of Maryland School of Law catalog.

MBA/MPM Joint Program

The College of Business and Management and the School of Public Affairs offer a joint program of studies leading to the MBA and MPM degrees. Under the terms of the joint program, a student may earn both degrees in approximately five semesters. The accelerated program is possible because some courses can be credited toward both degrees. Candidates must be admitted to both programs.

Under the joint program, 66 credits are required for graduation, split roughly equally between the programs. Grade point averages in each program will be computed separately and students must maintain minimum standards in each school to continue in the program. A student must complete both programs satisfactorily in order to receive both degrees. A student whose enrollment in either program is terminated may elect to complete work for the degree in which he or she remains enrolled, but such completion must be upon the same conditions as required of regular (nonjoint program) degree candidates. Student programs must be approved by the Associate Dean of the School of Public Affairs and the MBA Program Director. For further discussion of admission and degree requirements, students should see the general admission requirements for each program.

Facilities and Special Resources

The College faculty has been recruited from the graduate programs of leading universities in the nation. They are dedicated scholars, teachers and professional leaders with a strong commitment to academic excellence and the education of the professional manager and researcher.

Special programs offered by the College include courses in entrepreneurship through the Michael D. Dingman Center for Entrepreneurship and an MBA practicum course, BMGT 791, in which students research a problem of significant management concern in a participating firm or agency. Through graduate program requirements and faculty research activities, students gain exposure to private enterprise, to the public sector and to the vast education, research, library and cultural resources of Washington, D.C.

The students also have access to the exceptional academic and professional resources of the College Park campus including excellent library and computer facilities. A remote computer terminal and on-line teletype facilities are located in the building.

Financial Assistance

Financial aid is available to qualified students in the form of fellowships, graduate assistantships, work-study, scholarships, and for Ph.D. students, instructorships.

Additional Information

The College has available brochures that give specific degree requirements for the MBA and Ph.D. programs. Initial inquiries should be directed to:

Director of the Masters Programs
College of Business and Management
or
Director of the Doctoral Program
College of Business and Management
University of Maryland
College Park, MD 20742
(301) 405-2278

For courses, see code BMGT.

Chemical Engineering Program (ENCH)

Professor and Director: McAvoy

Professors: Asbjornsen, Cadman, Gentry, Regan, *Sengers, Smith, Weigand

Associate Professor: Calabrese, Choi, Gasner

Assistant Professors: Bentley, Lee, Mavrovouniotis, Payne, Rao, Wang, Zafiriou

*Joint appointment with Institute for Physical Science and Technology

The program director, an adviser and the student form an individual plan of graduate study compatible with the student's interest and background. The general chemical engineering program is focused on four major areas: applied polymer science, biochemical engineering, transport phenomena and process systems.

Admission and Degree Information

The programs leading to the Master of Arts and Doctor of Philosophy degrees are open to qualified students holding the Bachelor of Science degree. Admission may be granted to students with degrees in engineering and science areas from accredited programs, and it may be necessary in some cases to require courses to fulfill this background. The general regulations of the Graduate School apply in reviewing applications.

The M.S. program offers both a thesis and non-thesis option. The equivalent of at least three years of full-time study beyond the B.S. degree is required for the Ph.D.

degree. All students seeking graduate degrees in Chemical Engineering must enroll in ENCH 610, 620, 630 and 640 if they have not completed equivalent courses. In addition to Graduate School regulations, special degree requirements are included in Departmental publications.

Facilities and Special Resources

A number of special facilities are available for graduate study and research and are coordinated through the Polymer Reaction Engineering Laboratory, the Chemical Process Systems Laboratory, the Laboratory for Biochemical Engineering and the Biochemical Reactor Scale Up Facility. These laboratories contain advanced digital process control computers, AI computers, polymer processing equipment and polymerization reactors, polymer characterization instrumentation, a laser anemometry facility, a thermohydraulics facility and an aerosol characterization facility.

Additional Information

Director
Chemical Engineering Program
2115 Chemical and Nuclear Engineering Building
University of Maryland
College Park, MD 20742
(301) 405-1935

For courses, see code ENCH.

Chemical Physics Program (CHPH)

Director: McIlrath

Associate Director: Alexander

Professors: (CHEM) Alexander, Greer, Khanna, Mignerey, Miller, Moore, Tossell, Weiner; (ENCH) Gentry; (ENEE) Davis, Hochuli, Lee; (ENME) Gupta; (IPST) Coplan, Dorfman, Ginter, McIlrath, Sengers, Wilkerson; (PHYS) Das-Sarma, Einstein, Ferrell, Lynn

Associate Professors: (ENCH) Calabrese; (ENEE) Dagenais; (ENME) Radermacher; (IPST) Gammon; (IPST/CHEM) Thirumalai; (IPST/PHYS) Kirkpatrick; (METO) Dickerson, Ellingson; (PHYS) Williams

Assistant Professors: (CHEM) Reutt-Robey; (ENME) Herold; (IPST) Hill; (IPST/ENEE) Milchberg

Adjunct Professor: (IPST/NIH) Nossal

The Chemical Physics Program offers graduate study leading to both the Master Science and Doctor of Philosophy degrees for students who wish to establish a professional career in which a knowledge of both physics and chemistry is needed. Students can concentrate their studies in chemistry, physics, chemical engineering, electrical engineering, mechanical engineering or meteorology.

The Chemical Physics Program is under the joint sponsorship of the Institute for Physical Science and Technology and six academic departments: Chemistry, Physics, Electrical Engineering, Chemical Engineering, Mechanical Engineering and Meteorology. The Chemical Physics Committee oversees the program and is made up of representatives from the sponsoring units with the program director as its chair. The Chemical Physics Program Office administers the program and is affiliated with the

Institute for Physical Science and Technology. A booklet describing Chemical Physics at Maryland (College Park) can be obtained from the Chemical Physics Office upon request.

Faculty concentrate their research on a diversity of disciplines such as statistical mechanics, laser spectroscopy, intermolecular energy transfer, molecular dynamics, phase transitions, properties of fluids, fluctuation phenomena, biophysics, particle scattering, working fluid mixtures, thermodynamic cycles and surface science. Access to national research laboratories in the Washington metropolitan area is made possible through the joint research programs between these laboratories and the Chemical Physics faculty and through a cooperative graduate program in Molecular and Cellular Biophysics, which is jointly sponsored by the University of Maryland and the National Institutes of Health.

Admission and Degree Information

Students with an undergraduate major in physics, chemistry, engineering or mathematics may apply. A strong background in physics and some background in chemistry is desirable for successful completion of the program. Students admitted to the Chemical Physics Program will also be listed in the department of their chosen area of concentration.

The program will be adjusted to the needs of an individual student. For instance, if a candidate does not possess the required undergraduate background in both physics and chemistry, a faculty adviser will prescribe appropriate undergraduate courses. Candidates for the Ph.D. degree must pass the chemical physics qualifying examination. This exam is based on material covered by the physics qualifying examination in the areas of classical mechanics, quantum mechanics, statistical mechanics, thermodynamics, electricity and magnetism. It also covers chemical physics, atomic and molecular spectroscopy and structure, molecular bonding theory, chemical reaction dynamics and chemical thermodynamics. In addition to passing the Ph.D. qualifier exam, students must also take a graduate laboratory course, two semesters of seminar, two advanced courses and 12 credit hours of thesis research concluded by the presentation and defense of an original dissertation.

The M.S. degree program offers both a thesis or non-thesis option and is arranged for students on an individual basis with the approval of an adviser associated with the Chemical Physics Program. The thesis option requires the completion of 30 credit hours of coursework, including six hours of thesis research credit, a graduate laboratory course unless specifically exempted, two semesters of seminar and two advanced courses. In addition, the student must complete a thesis and pass an oral examination, which includes a defense of the thesis. For the non-thesis option, the student must complete 30 credit hours of coursework, including a graduate laboratory course unless specifically exempted, submission of a scholarly paper and a master's level pass on the Ph.D. qualifying exam. Students must maintain at least a 3.0 grade point average for both options.

Financial Assistance

Teaching and research assistantships are available for qualified students.

Additional Information

Requests for further information concerning the Chemical Physics Program can be obtained by writing to:

Professor T. J. McIlrath, Director
Chemical Physics Program (I.P.S.T.)
I.P.S.T. Building, Rm. 1109
University of Maryland
College Park, MD 20742
(301) 405-4781

For courses, see code CHPH.

Chemistry Program (CHEM)

Professor and Chair: Greer

Professor and Associate Chair: DeShong

Professors: Alexander, Ammon, Armstrong, Bellama, Castellan, Dunaway-Mariano, Freeman, Gerlt, Gordon, Greer, Grim, Hansen, Helz, Huheey, Jarvis, Khanna, Kozarich, Mariano, Mazzocchi, Mignerey, Miller, Moore, Munn, O'Haver, Ponnamperuma, Poulos, Stewart, Tossell, Walters, Weeks, Weiner

Professors Emeriti: Adler, Henery-Logan, Holmlund, Keeney, McNesby, Pratt, Rollinson, Stuntz, Svirbely, Vanderslice, Veitch

Associate Professors: Boyd, DeShong, DeVoe, Kasler, Murphy, Ondov, Sampugna, Thirumalai

Assistant Professors: Eichhorn, Falvey, Herndon, Julin, Poli, Reutt-Robey

The Chemistry Department offers graduate study leading to the Master of Science or the Doctor of Philosophy degrees with specialization in the fields of analytical chemistry, biochemistry, bioorganic chemistry, bioinorganic chemistry, chemical physics (in cooperation with the Institute of Physical Sciences & Technology and the Department of Physics and Astronomy), environmental chemistry, inorganic chemistry, nuclear chemistry, organic chemistry and physical chemistry. The graduate program in biochemistry is described separately in this catalog.

Admission and Degree Information

The M.S. degree program offers both the thesis and non-thesis option. Copies of regulations concerning diagnostic examinations, comprehensive examinations and other matters pertaining to coursework are available from the Department of Chemistry and Biochemistry.

Facilities and Special Resources

The Department has many special research facilities to support research in the fields listed above. Facilities include "clean" rooms for lunar and environmental sample analysis, X-ray crystallographic instrumentation, two mass spectrometers, eight NMR spectrometers including 60, 90, 200, 400 and 500 MHz Fourier-transform NMR spectrometers, ESCA spectrometers, ultracentrifuges, analytical optical spectrometers, a VAX network and a computer graphics facility. Departmental research is supported on two computers in the Computer Science Building, a UNIVAC 1100/92 and an IBM 3081, both of which are accessible by remote time-sharing terminals. The Department has an excellent glassblowing shop, a student-faculty machine shop and access to other campus machine shops. The Chemistry Library has an extensive collection in chemistry, biochemistry and other fields. A computer terminal is located in the Chemistry Library for literature searching.

Financial Assistance

Entering graduate students are normally supported on graduate teaching assistantships. Teaching assistants usually instruct undergraduate laboratory and recitation classes and receive in return a tuition waiver for a 10 credit program of graduate study each semester.

Additional Information

A Department brochure describes the graduate program and the research interests of the faculty. For a copy of the brochure, or for specific information on graduate programs in chemistry, admissions procedures or financial aid, contact:

Director of Graduate Studies
Department of Chemistry and Biochemistry
University of Maryland
College Park, MD 20742
(301) 405-1796

For courses, see CHEM.

Civil Engineering Program (ENCE)

Professor and Chair: Colville

Professors: Aggour, Albrecht, Birkner, Carter, McCuen, Pilcher, Ragan, Sternberg, Witczak, Wolde-Tinsae

Associate Professors: Ayyub, P. Chang, Garber, Goodings, Hao, Schelling, Schonfeld, Schwartz, Vannoy

Assistant Professors: Austin, Bernold, G. L. Chang, Davis, Kartam

The Department of Civil Engineering offers graduate courses leading to the Master of Science and Doctor of Philosophy degrees. All programs are planned on an individual basis by the student and an adviser taking into consideration the student's background and special interests. Course and research opportunities are available in the general areas of transportation and urban systems, environmental engineering, water resources, structural engineering, geotechnical engineering, and construction engineering and management. In general, emphasis is on learning sound engineering principles and applying them to human needs.

Admission and Degree Information

Applicants for admission should hold a B.S. degree in civil engineering. However, applicants with undergraduate degrees in other disciplines may be accepted with the stipulation that deficiencies in prerequisite undergraduate coursework be corrected before enrolling in graduate courses. There are no entrance examinations required for the program.

The M.S. degree program offers both a thesis and non-thesis option. The Department's policies and requirements are the same as those of the Graduate School.

The requirements for the Ph.D. degree are also the same as those posed by the Graduate School. The student and an adviser develop an approved program of study suited to his or her individual needs. Before admission to candidacy, the student must pass a qualifying examination, which is normally taken after the coursework is at least 75 percent completed. There is no language requirement for the Ph.D.

Facilities and Special Resources

Departmental research facilities include laboratories in the following areas: transportation, systems analysis, environmental engineering, hydraulics, remote sensing, structures and soil mechanics. Computer facilities include the Computer Science Center's Unisys 1100/92 and IBM 3081 computers complemented by remote terminals and mini- and micro-computer systems located within the department, and a joint Civil Engineering/Mechanical Engineering CAD Laboratory.

The Washington and Baltimore metropolitan areas are easily accessible for data, field studies, library access, contacts with national organizations and attendance at national meetings. The location of the University of Maryland offers a unique opportunity to obtain an advanced degree in civil engineering.

Additional Information

Chair
Department of Civil Engineering
Engineering Classroom Building
University of Maryland
College Park, MD 20742
(301) 405-1980

For courses, see code ENCE.

Classics Program (CLAS)

Professor and Chair: Rowland

Associate Professors: Duffy, Hallett, Hubbe, Staley

Assistant Professors: Doherty, Stehle

Visiting Faculty (1990-91): Fiedler, Dexter, Jones, Mejer

The Department of Classical Studies offers a graduate program of study with specializations in Latin, Latin and Greek, and Classical Civilization leading to the Master of Arts degree. The program provides students with advanced study of the Latin and/or Greek languages and literatures in the context of a broader and deeper knowledge and understanding of Greek and Roman culture and civilization. In addition to advanced courses in language, each student will be required to take coursework in related disciplines outside of the Classics Department. Some individual programs may require more than 30 hours. Students may choose one of three tracks toward the degree: Latin, Latin and Greek, or Civilization of the Classical World. The Department of Ancient Studies at the University of Maryland-Baltimore County cooperates in offering this program; however, no more than 12 credits earned at UMBC will be accepted to satisfy the requirements for this degree.

Requirements and Areas of Concentration

The Latin program requires a minimum of 30 hours of approved coursework, including six credits of thesis research. Twelve of these credits must come from at least 600-level Latin courses; six credits must be from period courses LATN 620-630. Two 600-level or higher Latin courses may be substituted for the thesis with permission. An independent research project may also be an acceptable alternative for the thesis. Six of the 30 hours at the 400-level or above must be in aspects of classical civilization

offered in archaeology, art, history, linguistics, philosophy, Romance philology or in approved allied fields.

The Latin and Greek Program requires a minimum of 33 hours of approved coursework, including six credit hours of thesis research. Nine hours of coursework in one language and three in the other must be at the 600-level or higher. Two courses in the languages at the 600-level or higher may be substituted for the thesis with permission. An independent research project may also be an acceptable alternative for the thesis. Six of the 33 hours at the 400-level or above must be in aspects of Classical civilization through courses offered in archaeology, art, history, linguistics, philosophy, Romance philology or in approved allied fields.

The Civilization of the Classical World Program requires a minimum of 30 hours of approved coursework, including six credit hours of thesis research. Twelve of those hours must be at the 600-level or higher, and six of those twelve must be in either Latin or Greek language courses or in any combination of the two. The other six hours at the 600-level or higher will be in the study of Classical civilization or the classical tradition through courses offered in archaeology, art, classics, history, philosophy or in approved allied fields. An independent research project may be an acceptable alternative for the thesis. The remaining six hours, which must be at the 400-level or above, can be in aspects of Classical civilization in courses offered either by the Classics Department or in archaeology, art, history, linguistics, philosophy, Romance philology or in approved allied fields. Students in this concentration will have an advisory committee of three faculty members appointed by the Departmental chair. For courses, see codes CLAS, GREK, and LATN.

Comparative Literature Program (CMLT)

Professor and Director: Heyndels

Professors: Beck, Beicken, Bentley, Best, R.H. Brown, Bryer, Clignet, R. Cohen, Damrosch, David, Difederico, Freedman, Fuegi, Gillespie, Gramberg, Haber, Herin, Holton, Jones, Kerrigan, Kolker, Lifton, MacBain, Oster, Pacheco, Panichas, Patterson, Price, Rimer, Rowland, J. Russell, Schoenbaum, Sosnowski, Sutherland, Tarica, Therrien, Wittreich

Visiting Professors: Bourdieu, Haarscher, Knox, Leenhardt, Logan, Semprun

Associate Professors: Barry, Bennett, Berlin, Bilik, Birdsall, Caramello, Carretta, Caughey, Coogan, Diner, Duffy, Fink, Flieger, Fredericksen, Glad, Grimsted, Gullickson, Hage, Hallett, D. Hamilton, G. Hamilton, Handelman, J. Harris, Herman, Igel, Joyce, Kelly, Kerkham, Klein, Klumpp, Levinson, Loizeaux, Martin, Mintz, Odell, Peterson, Pfister, J. Robinson, C. Russell, Staley, Trousdale

Assistant Professors: Aguilar-Mora, Blum, Falvo, Dungey, Kristal, Leinwand, Levine, Marchetti, E. Robinson, Stehle, Strauch, Zappala

The Comparative Literature Program and Center for Critical Studies offer graduate study leading to the Master of Arts and Doctor of Philosophy degrees. A distinguished faculty offers concentrated coursework in major movements and genres, in literary theory and in literature and the other arts. The Program's greatest strength currently lies in the history and criticism of dramatic literature, in the novel, in sociology of literature and culture, and in film studies. Interdisciplinary work as well as practical criticism in the arts are both encouraged. The three main priorities of the program are:

1. The critical theory and socio-philosophical approach of the literary process (including cultural anthropology);
2. The study of literature as a part of the global "representation" and symbolic process (with an emphasis on film studies and drama);
3. The historical and theoretical approach to the relationship between literature and the arts (including painting, photography, music, architecture, etc.).

The Program is concerned with the following fields: English, American, French and Italian, German, Russian, Spanish and Portuguese and Latino-American literatures; American, Women's, East Asian and Jewish studies; Classics, History, Sociology, Philosophy, Arts and History of the Arts, Theatre, Radio-Television-Film and Music.

Admission and Degree Information

Applicants should have a strong background in the arts and humanities. Advanced work in comparative literature is based on the premise that literature should be read in the original whenever possible; students are expected to be able to read at least one language other than English with a high degree of aesthetic appreciation. Ph.D. students should be able to use at least two foreign languages actively in their work, and it is assumed that efforts will be made to develop an acquaintance with one or two additional languages. Entrance examinations are not required, but high scores on GRE literature and language examinations will add weight to credentials.

Students take courses in CMLT and affiliated departments and programs. The M.A. degree requires 30 credits, composed of 24 hours of coursework, a comprehensive examination and a thesis, or 30 hours of coursework and a comprehensive examination. To enter the Ph.D. program, the M.A. thesis is highly recommended. No specific number of credits is required for the Ph.D. as the number will vary according to the preparation and goals of the individual student. The average has been eight to 10 courses beyond the master's degree, which is required for the Ph.D. The Ph.D. comprehensive examinations, determined after consultation with the individual student's committee, cover four major areas, including a genre, a period, a required theory examination and a non-literary field.

Facilities and Special Resources

The program regularly draws upon the resources of the Library of Congress, the Kennedy Center, the Folger Library, the American Film Institute, Kennan Institute and Dumbarton Oaks, and many internship possibilities exist in the greater Washington area. Internships are also available abroad (in the framework of the "Maryland in Europe/Europe at Maryland" program and the Visual Press, cf. infra) as are graduate exchange programs with European universities. Students have ready access to all the museums, galleries, libraries and cultural institutions of the Washington D.C. metropolitan area and the Washington-Baltimore-Philadelphia-New York corridor.

The Center for Critical Studies is the research unit of the program and is designed to promote theoretical inquiry in literature and the other arts and to sponsor practical and engaged criticism. Its emphasis is on interdisciplinary scholarship rather than the study of texts in isolation. It is therefore particularly concerned with the arts in performance, with reception and communication theory, with contemporary theory of criticism and with the practice of criticism in the mass media. To achieve its intent of

mediating between theory and practice, the Center brings together theoreticians, artistic creators and working critics; it organizes scholarly symposia of which findings are broadly disseminated, and it sponsors internships for critics who either work or seek to work in the different fields of cultural and symbolic creation.

Special ties link the Center for Critical Studies with Brussels' Center for Sociology of Literature, the Center for Sociology of Literature of the Ecole des Hautes Etudes en Sciences Sociales (Paris) and other similar European institutions.

The CMLT Program and Center for Critical Studies, in cooperation with several departments and schools, are also running a comprehensive international academic, artistic and cultural exchange program called "Maryland in Europe/Europe at Maryland".

A special interdisciplinary visiting professorship is based in the Comparative Literature Program, which is sponsored by the Perelman Foundation (Brussels – Jerusalem). Each academic year, a highly distinguished and internationally recognized scholar who comes from the U.S. or abroad is invited into the program as the Perelman Visiting Professor.

The Comparative Literature Program also hosts the Brecht Yearbook (a CMLT faculty is the editor-in-chief) along with the campus-wide Visual Press of which the director is also a member of the CMLT faculty. The Visual Press is responsible for several international media/film/video projects, including "Beckett Directs Beckett," "Nothing Immoral: Brecht," "The Social History of Climate," "The Maryland Seminars on European Cultural Issues," etc.

Financial Assistance

Various teaching and research assistantships and university fellowships are available as well as some special fellowships. CMLT students may teach in various departments cooperating in the CMLT Program and may be considered for a year abroad as a teacher at cooperating European universities.

Additional Information

For more specific information about the program, contact:

Director
Comparative Literature Program
Jimenez Hall
University of Maryland
College Park, MD 20742
(301) 405-3809

For courses, see code CMLT.

Computer Science Program (CMSC)

Professor and Chair: Tripathi

Professors: Agrawala, Basili, Chu, Davis, Edmundson, Gannon, Kanal, Miller, Minker, O'Leary, Rosenfeld, Samet, Shneiderman, Stewart, Tripathi

Affiliate Professors: JaJa, Vishkin

Associate Professors: Austing, Kruskal, Nau, Perlis, Reggia, Roussopoulos, Shankar, Smith, Zelkowitz

Assistant Professors: Aloimonos, Amir, Carson, Elman, Faloutsos, Furuta, Gasarch, Hendler, Jalote, Johnson, Kruskal, Mark, Mount, Pugh, Purtilo, Rombach, Salem, Sellis, Stotts, Subrahmanian

Affiliate Assistant Professor: Ricart

The Department of Computer Science offers graduate study leading to the Master of Science and Doctor of Philosophy degrees with research emphasis in the following areas: artificial intelligence, data bases, computer vision, numerical analysis, programming languages, software engineering, computer systems and theory of computing.

Admission and Degree Information

Admission and degree requirements specific to the graduate programs in computer science are described in a brochure available through the Departmental Graduate Office. The master's program offers two options: 1) 24 hours of coursework and the completion of a thesis, or 2) 30 hours of coursework, a comprehensive examination and the completion of a scholarly paper. There are no explicit course requirements in the doctoral program. The number and variety of courses offered each semester enables students and their advisers to plan individualized programs.

Facilities

The Department is located in the A.V. Williams Building, a state-of-the-art research facility. The Department's research laboratories contain a DEC 8600, a VAX 11/785 and an Encore Multimax 510. More than 80 Sun and DEC workstations are networked together running Sun UNIX. Workstations from several other manufacturers are also available.

The Department has direct INTERNET and BITNET access (address: name mimsy.umd.edu).

BITNET access is available through campus INTERNET/BITNET gateways.

The Department maintains close ties with the campus' Center for Automation Research (CFAR) and the University of Maryland Institute for Advanced Computer Studies (UMIACS). Many students and faculty have access to CfAR and UMIACS facilities and equipment. CfAR has two VAX 11/785s, several Symbolics 3600s and two Butterfly parallel processors, and UMIACS has a Connection Machine. The Department also has close ties to the Center for Excellence in Space Data and Information Sciences (CESDIS) at NASA Goddard Space Flight Center in Greenbelt, MD, and research facilities there are available for collaborative projects.

Financial Assistance

Graduate assistanthips in both the educational and research programs are offered to qualified applicants based on academic performance. CfAR, UMIACS, CESDIS and the Systems Research Center (SRC) offer a number of assistantships. Graduate School, departmental and minority fellowships are also available.

Additional Information

For information on degree programs and graduate assistantships contact:

Graduate Office
Department of Computer Science
1119 A.V. Williams Building

University of Maryland
College Park, MD 20742
(301) 405-2664
For courses, see code CMSC.

Counseling and Personnel Services Program (EDCP)

Professor and Chair: Hershenson

Professors: Birk, Marx, Power, Pumroy[1], Schlossberg

Associate Professors: Boyd[2], Greenberg, Hoffman, Lawrence, Leonard[2], Medvene[2], Rhoads, Scales[2], Sedlacek[2], Strein, Teglasi, Westbrook[2]

Assistant Professors: Bagwell[3], Clement[3], Cook, Cuyjet[3], Fassinger, Freeman[2], Gast[4], Hrutka[3], Jacoby[3], Komives, Kreiser[5], Lucas[2], McEwen, Mielke[3], Molla[3], Osteen[3], Otani[2], Schmidt[3], Stewart[3], Stimpson[3], Thomas[3]

[1]joint appointment with Psychology
[2]joint appointment with Counseling Center
[3]joint appointment with Student Affairs
[4]joint appointment with Career Development Center
[5]joint appointment with College of Education Dean's Office

The Department of Counseling and Personnel Services offers graduate programs designed to provide the knowledge and skills needed for practice and scholarship in counseling and related human service professions. These fields are concerned with assisting people individually, in groups and in organizations to attain their optimal level of personal, social, educational and career functioning. Graduates are employed in a variety of settings including schools, colleges and universities, mental health agencies, rehabilitation agencies, correctional facilities, business and industry, government agencies, other community service facilities and private practice. These professionals may serve any of several roles either at the practitioner's level or at an advanced level as supervisors, researchers, educators or program administrators. Master's level professional entry-level programs are offered in five areas of specialization.

1) The School Counseling program prepares students to become school counselors in elementary, middle and high school settings. School counselors provide individual and group counseling to school-aged children, coordinate pupil services in schools and function as consultants to classroom teachers, school administrators and parents. 2) The School Psychology program prepares students for certification as school psychologists, whose principal duties are to assess intellectual and emotional factors that affect pupils' functioning in school settings and to devise intervention strategies to enhance the learning and behavioral adjustment of pupils. 3) The College Student Personnel program prepares specialists for service in higher education settings as counselors and as administrators of student affairs services. 4) The Community Counseling program prepares counselors to work in career counseling, community mental health and adult development. 5) The Rehabilitation Counseling program prepares counselors to work with persons who have mental, emotional, social or physical handicaps.

Because of differences in certification, licensure and employment requirements across specialty areas, professional entry-level programs of two types are offered, depending on the area of specialization: 1) a master's degree program (M.A., thesis required or M.Ed., thesis not required), or 2) an integrated Master's/Advanced Graduate Specialist

(A.G.S.) program. In this program, the student is admitted to the full sequence, takes the master's comprehensive examination after 24 hours of coursework, writes a master's thesis (for an M.A.) after about 24 more hours of coursework, then takes the A.G.S. comprehensive examination while completing the degree and A.G.S. certificate simultaneously. The applicant should contact the Department for further information concerning the entry-level requirements and curriculum of each area of specialization.

The A.G.S. certificate is offered in all of the aforementioned areas of specialization. For individuals who hold a master's degree in counseling or a closely related field, this certificate program may serve: 1) to provide the additional education required for professional certification or licensure in those specialty areas that require a program of two year's length, and/or 2) to provide the academic background for an advanced level of professional practice within a specialty area.

The Ph.D. degree in Counseling and Personnel Services is offered in four areas of specialization: a) Counseling Psychology (in collaboration with the Psychology Department), b) School Psychology, c) College Student Personnel Administration, and d) Counseling and Consultation. Doctoral studies prepare students to achieve exceptional competence in the theory and practice of their field; to develop a high level of skills as researchers, educators and administrators; and to assume positions of leadership in various relevant settings. Students in the Counseling Psychology specialization are educated to work as counseling psychologists and supervisors in such settings as college and university counseling centers, community mental health agencies and academic departments. Doctoral-level school psychologists serve as advanced level practitioners, supervisors, administrators, researchers and school psychology teachers. Students in College Student Personnel Administration are prepared to assume leadership positions as administrators of college or university student personnel services or as teachers and researchers of college student personnel work. Doctoral students in Counseling and Consultation are prepared to assume roles as supervisors, educators or researchers in school counseling, rehabilitation, career development or community counseling programs. All Ph.D. students are expected to attain advanced skills as both practitioners and researchers in their area of specialization.

Professionally accredited programs within the Department include the School Psychology and Counseling Psychology doctoral programs, which are accredited by the American Psychological Association. The Rehabilitation Counseling Masters (M.A. or M.Ed.) Program is accredited by the Council on Rehabilitation Education. The M.A./A.G.S. Program in School Psychology and the Master's (M.A. or M.Ed.) Program in School Counseling are approved for certification by the Maryland State Department of Education and are accredited by the National Council for Accreditation of Teacher Education. The Masters (M.A. or M. Ed.) Program in Community Counseling and the Ph.D. Program in Counseling and Consultation are accredited by the Council for Accreditation of Counseling and Related Educational Programs (CACREP), a specialized accrediting body recognized by the Council on Postsecondary Accreditation (COPA).

Admission and Degree Information

Applicants for regular admission to master's degree programs must have an undergraduate average of B (3.0 on a 4.0 scale) and must submit their scores on the Miller Analogies Test or Graduate Record Examination (required for School Psychology

M.A./A.G.S. program). The undergraduate program must include at least 15 semester hours of coursework in behavioral science fields (anthropology, education, psychology, sociology and/or statistics). Applicants for admission to A.G.S. and Ph.D. programs must have a master's degree in counseling or a closely related field. A grade point average of 3.5 in prior graduate work is required with an acceptable score on the Miller Analogies Test or the Graduate Record Examination (for Counseling Psychology and School Psychology). Selective screening of qualified applicants is necessary in order to limit enrollment to the Department's available faculty resources.

Departmental comprehensive examinations are required of all master's, A.G.S. and doctoral students. All doctoral students are required to take advanced courses in statistics and research design.

Facilities and Special Resources

All master's, A.G.S. and doctoral students are required to include supervised fieldwork experiences in their degree programs. The Department has excellent cooperative relationships with the Division of Student Affairs (including such offices as the Counseling Center, Orientation, Campus Activities, the Student Union, Resident Life and Commuter Affairs), with units in Academic Affairs (such as Advising, Career Development, Admissions and Experiential Learning) and with units in University College. Fieldwork may also be done at a wide variety of school systems, counseling services and mental health agencies in the Maryland/District of Columbia area.

In addition to campus and Department resources, students also utilize the many major research and professional institutions that are easily accessible to the campus. These include the Library of Congress, the National Library of Medicine, the National Institutes of Health and of Education, the American Psychological Association and the American Association for Counseling and Development.

Financial Assistance

The Department offers several graduate assistantships, and paid experiences have been arranged for some students in the Department with a variety of on- campus and off-campus agencies.

Additional Information

For individual brochures describing the curriculum of each professional entry-level and each doctoral specialization, contact:

Chair
Counseling and Personnel Services Program
3218 Benjamin Building
University of Maryland
College Park, MD 20742
(301) 405-2858

For courses, see code EDCP.

Criminal Justice and Criminology Program (CRIM)

(Institute of Criminal Justice and Criminology)

Director and Professor: Wellford

Professor Emeritus: Lejins

Professors: Loftin, Sherman

Associate Professors: Ingraham, Maida, Paternoster, Smith

Assistant Professors: Gottfredson, Simpson

The program of graduate study leading to Master of Arts and Doctor of Philosophy degrees in the area of Criminal Justice and Criminology is intended to prepare students for research, teaching and professional employment in the operational agencies of the criminal justice field. This program combines an intensive background in a social science discipline such as criminology, criminal justice, sociology, psychology and public administration with graduate-level study of selected aspects of the criminal justice field.

A recent study of Institute M.A. and Ph.D. alumni reveals that master's degree graduates have found employment in both public and private institutions in virtually every kind of activity associated with the criminal justice system: research; teaching; federal, state and local law enforcement; courts; corrections; private security; funded programs; etc. Ph.D. graduates have found employment mostly in teaching, research and government agency administration.

Admission and Degree Information

In addition to the general Graduate School rules, special admission requirements include the Graduate Record Examination Aptitude Test, a major in a social science discipline and nine hours of coursework in the appropriate area of criminal justice. For the M.A. applicant, the undergraduate social science major must have included at least one course each in theory, statistics and research methods. The Ph.D. applicant must have completed two courses each in statistics, research methods and theory; one course in each area must be at the master's level. Admission to the Ph.D. program presupposes completion of the M.A. degree. At the discretion of the Institute's Graduate Admissions Committee, deficiencies in some of the above areas may be made up by noncredit work at the beginning of the program.

M.A. students may choose either a criminology or a criminal justice option. The general plan of study for both options is as follows: 30 semester hours of courses consisting of: 1) at least six courses in criminology and criminal justice, four of which are required courses that must be passed with a "B" or better; 2) a graduate level course in statistics, the course to be selected from an approved list; 3) six hours of either thesis credit or additional coursework depending on the option selected by the student; and 4) one elective course. The M.A. degree offers both a thesis option and a non-thesis option with some additional requirements.

In addition to the general Graduate School requirements, competence in research methodology and in quantitative techniques is expected for the completion of the Ph.D. degree, as well as competence in the general theory of the criminal justice field and in the specialization area selected by the student. The necessary coursework is determined on the basis of the student's previous preparation, needs and interests. The candidate is required to pass comprehensive examinations.

Financial Assistance

Graduate teaching assistantships are available on a competitive basis. Graduate research assistantships are also sometimes available for graduate students to participate in research projects directed by faculty members and funded by outside sources.

Additional Information

A brochure describing the Institute of Criminal Justice and Criminology and its programs is available upon request. Inquiries should be directed to:

Graduate Program Coordinator
Institute of Criminal Justice
University of Maryland
College Park, MD 20742
(301) 405-4699

For courses, see code CRIM and CJUS.

Curriculum and Instruction Program (EDCI)

Chair: Ann C. Howe

Professors: Arends, E.G. Campbell, Fein, Fey[5], Folstrom[1], Gambrell, Holliday, Howe, Jantz, Johnson, Layman[6], Lockard[2], Roderick, Weaver, Wilson

Associate Professors: Amershek, Borko, Brigham, P. Campbell, Cirrincione[3], Craig, Davey, Davidson, DeLorenzo, Dreher, Eley, Farrell[4], Heidelbach, Henkelman, Herman, Klein, McCaleb[7], McWhinnie[8], Saracho, Slater

Assistant Professors: Carey, Dierking, Graeber, Markham, O'Flahavan, Williams[9]

[1]joint appointment with Music
[2]joint appointment with Botany
[3]joint appointment with Geography
[4]joint appointment with History
[5]joint appointment with Mathematics
[6]joint appointment with Physics
[7]joint appointment with Communication Arts and Theatre
[8]joint appointment with Housing and Applied Design
[9]joint appointment with Library and Information Services

The Department offers graduate study leading to the following degrees or certificates: Master of Arts (thesis and non-thesis), Master of Education, Advanced Graduate Specialist, Doctor of Education and Doctor of Philosophy. The Department offers a variety of programs individually designed to meet the graduate students' personal and professional goals, which may include educational research, teaching, supervising, providing leadership as curriculum specialists within the disciplines, teacher education or consulting at all levels of instruction; early childhood, elementary, secondary and higher education. Programs are offered to meet the needs of professionals in school and non-school settings and are available on the College Park campus. Some programs are available in off-campus centers.

Areas of emphasis include art education, early childhood education (birth to eight years of age), elementary education, social studies education, language arts education (English education, foreign language education, English as a second language education, speech and theater education), mathematics education, music education, professional development, reading education, science education and computers in education.

Admission and Degree Information

The master's degree requires a minimum of 30 to 36 semester hours. Students must complete 60 hours beyond the bachelor's degree for the A.G.S. certificate, and the doctorate requires a planned sequence of approximately 60 semester hours beyond the master's degree. Programs include both theory and practicum, professional work, research and academic courses. There are no foreign language requirements unless the dissertation is on a topic that requires it. Students must have a 3.0 undergraduate grade point average and submit either the Miller Analogies Test or the Graduate Record Examination test scores for admission to the master's program. Admission to an A.G.S. or doctoral program requires a 3.5 grade point average in previous graduate studies and either a 3.0 undergraduate grade point average or at least a 40 percentile on the Miller Analogies Test or Graduate Record Examination.

Master's degree students are required to take a six-hour comprehensive examination near the end of their program. Doctoral students are required to take a preliminary examination after approximately 12 semester hours of work and a comprehensive examination near the completion of the program. An oral examination in defense of the dissertation constitutes the final step in completing the doctorate.

Facilities and Special Resources

The Department's facilities in the Department that support graduate study include the Micro Teaching and Decision Making Laboratory, the Center for Mathematics Education, the Center for Young Children, the Reading Center and the Science Teaching Center. Additional facilities in the College of Education include the Educational Technology Center, the Curriculum Laboratory and Teacher Education Centers in local schools.

Financial Assistance

A number of graduate assistantships are available in the Department of Curriculum and Instruction. These assistants research, supervise student teachers and teach undergraduate classes.

Additional Information

For more specific information, contact:

Chair
Department of Curriculum and Instruction
2311B Benjamin Building
University of Maryland
College Park, MD 20742
(301) 405-3324

For courses, see code EDCI.

Dance Program (DANC)

Professor and Chair: Wiltz

Professors: Rosen, A. Warren, L. Warren

Associate Professor: Dunn

Professor Emeritus: Madden

Assistant Professor: Frosch-Schroder

Lecturer: Jackson

The Department of Dance offers a Master of Fine Arts degree in Dance with an emphasis on either performance or choreography. It is designed to give outstanding students advanced training and opportunities for creative growth. The program will prepare the student for the professional world as a dancer, choreographer or teacher on the college level.

The competencies that students learn during the program will allow them to teach a broad range of dance and dance-related subjects after they graduate. They should be able to present and produce dance in a number of contexts and modalities both on the campus and in the community. The program is designed to broaden all aspects of the artist's understanding of dance. Important emphasis will be given to dance history and philosophy and the study of current issues in the field. We wish our graduates to exhibit a high degree of insight into the cultural contexts in which dance has developed in the past and continues to develop today.

Students in both the performance and choreography emphases will be expected to spend a significant amount of time learning about stage lighting, costuming and sound, as well as promotion and house management and the myriad of other organizational details that go into producing a dance performance. They will be actively involved in the practical application of this knowledge as part of their training. Graduates who understand every aspect of the theater needed to successfully present a dance performance will find themselves more highly employable both in the performance and educational fields of the profession.

Admission and Degree Information

Students enrolled in the program must complete a total of 60 credit hours of study to graduate and will be juried on a regular basis to determine their progress.

Graduation from the program requires the successful completion of a final project demonstrating a synthesis of craft and artistic understanding as well as professional competence in the area of concentration. Final projects may follow two emphases: (1) the thesis project for the choreographic emphasis will consist of the public presentation of a body of dance works choreographed by the candidate; (2) the thesis project for the performance emphasis will consist of the public presentation of a body of dance works featuring the candidate in performance.

For both emphases the total performance time is to be equivalent to a substantial dance concert. A written report documenting the project must be submitted, consisting of a thorough analysis and evaluation of the process through which the project was realized.

Facilities and Resources

The location of campus, eight miles away from Washington D.C., places the Department a half hour away from America's second city of dance where one may study and enjoy a wide variety of offerings of ballet, modern and ethnic dance.

Financial Assistance

A limited number of teaching assistantships that include partial or full tuition remission is available. Minority candidates may apply for Graduate School fellowships; the deadline is February 1.

Additional Information

The *Guidelines for the Graduate Program* provide course requirements, examination procedures and descriptive materials for the M.F.A. program. For specific information, contact:

Professor Alcine J. Wiltz, Chair
Department of Dance
University of Maryland
College Park, MD 20742
(301) 405-3180

For courses, see code DANC

Economics Program (ECON)

Professor and Chair: Straszheim

Professors: Aaron, Adams, Almon, Baily, Betancourt, Brechling, Clague, Cumberland, Dorsey, Harris, Hulten, Kelejian, McGuire, Mueller, Murrell, Myers, Oates, Olson, Panagariya, Polakoff, Schelling, Wonnacott

Professors Emeriti: Bergmann, Dillard, O'Connell, Ulmer

Associate Professors: Abraham, Bennett, Coughlin, Cropper, Haltiwanger, Knight, Meyer, Montgomery, Poetscher, Prucha, Schwab, Wallis, Weinstein

Assistant Professors: Anderson, Dellas, Evans, Haliassos, Hoff, Kessides, Lyon, Williams

The Economics Program offers graduate study leading to both the Master of Arts and Doctor of Philosophy degrees. Areas of specialization include: economic theory, advanced macro, advanced micro, comparative economic systems and planning, econometrics, economic development, economic history, environmental and natural resource economics, history of economic thought, industrial organization, institutional economics, international economics, labor economics, monetary economics, public choice, public finance, regional economics and urban economics.

Admission and Degree Information

Applicants should have taken (or should plan to take immediately) advanced undergraduate courses in microeconomics, macroeconomics and statistics. Applicants are also expected to have completed two or more semesters in calculus and additional mathematics. The Aptitude Test section of the Graduate Record Examination is required, and the Advanced Economics Test is strongly recommended. Letters of recommendation from three persons competent to judge the probability of the applicant's success in graduate school should be sent directly to the Director of Graduate Studies in Economics. Part-time graduate study is not encouraged since few courses are taught at night.

The M.A. degree program offers both a thesis option (24 hours plus a thesis) and a non-thesis option (30 hours, including Economics 621-622, a written examination in economic theory, and a research paper). The requirements for the M.A. non- thesis option are met automatically in the course of the Ph.D. program in Economics.

The Ph.D. program requires: (1) a written examination in economic theory, normally taken at the beginning of the second year of study; (2) written examinations in two selected fields; (3) completion of a sequence of work in econometrics; and (4) a dis-

sertation. Additional work in theory, methods and fields is normally expected. In the third year, students begin directed research by participating in workshops appropriate to their dissertation research.

Facilities and Special Resources

The graduate program in Economics is a comprehensive one. The Department is uniquely strong in the Economics of the Public Sector and Public Choice. The Department has strong focuses in industrial organizations, macroeconomics, natural resources and the environment, international economics and economic development and other applied areas as well. Faculty members also supervise special research projects in inter-industry forecasting and other fields.

Financial Assistance

Research assistantships are available in special projects. Numerous teaching assistantships are also available. The Department can usually help graduate students find part-time employment in federal agencies engaged in economic research. There are a limited number of fellowships available, including several for members of groups who are under-represented among economists.

Additional Information

A complete description of the requirements of the degrees in economics and the admission process is available on request from:

Director of Graduate Studies in Economics
Department of Economics
University of Maryland
College Park, MD 20742
(301) 405-3512

For courses, see code ECON.

Education Policy, Planning and Administration Program (EDPA)

Professor and Chair: Warren

Professors: V. Anderson (Emeritus), Ancrews, Berdahl, Berman, Birnbaum, Carbone, Chait, Clague, Dudley, Finkelstein, Male, McClure (Emeritus), McLoone, Newell (Emeritus), Stephens

Associate Professors: Agre, Goldman, Hopkins, Huden, Lindsay, Noll, Schmidtlein, Selden, Splaine

Assistant Professors: Heid, Leak

Lecturer: Bensimin

Affiliate Assistant Professor: Edelstein

Adjunct Professors: Heynemann, Hickey

Adjunct Associate Professor: Hogan

Adjunct Assistant Professor: McKay

The Department of Education Policy, Planning and Administration offers programs of study for the Master of Arts, Master of Education, Doctor of Education and Doctor of Philosophy degrees as well as the Advanced Graduate Specialist (A.G.S.) certificate. Areas of specialization include: administration and supervision, curriculum theory and development, education policy, higher and adult education, and social foundations of

education. Ed.D. programs are offered at several off- campus sites as well as the College Park campus. Programs are tailored to students' objectives and backgrounds. Graduates enter careers in research, administration, policy making, planning, supervision or teaching in public or private schools, adult and higher education, non-school educational settings, government agencies or community organizations. Some graduates find career opportunities in other countries or with international organizations dealing with education.

Admission and Degree Information

Admission requirements for the master's program require a 3.0 undergraduate grade point average and at least a 40 percentile on the Miller Analogies Test or the Graduate Record Examination. Admission to an A.G.S. or Doctoral program requires a 3.5 grade point average in previous graduate studies, a 3.0 undergraduate grade point average and at least a 70 percentile on the Miller Analogies Test or Graduate Record Examination. Selective screening of qualified applicants is necessary to limit enrollment to the available faculty resources. Once a student is admitted, a program is tailored to meet his/her individual objectives and background. Doctoral students take a preliminary examination early in their programs, and all graduate students must take comprehensive examinations.

A research, teaching or administrative internship is required in most department programs. The internship is performed under faculty supervision in schools, colleges or agencies appropriate to the student's professional interests.

Facilities and Special Resources

The Department has established a liaison with area schools, colleges and local, state and federal education agencies to facilitate the use of these agencies for research and field experiences. Embassies in Washington, D.C. provide access to materials for the study of foreign education systems. The Department is associated with the International Center for the Study of Education Policy and Human Values, the Comparative Education Center, the Institute for Research in Higher and Adult Education, the Research and Development Laboratory on School- Based Administration and the Council for Curriculum Development and Change.

Financial Assistance

Some graduate assistantships are available to qualified graduate students.

Additional Information

For information and a Departmental brochure, please contact:

Department Chair
Department of Education Policy, Planning and Administration
Benjamin Building
University of Maryland
College Park, MD 20742
(301) 405-3574

For courses, see code EDPA.

Electrical Engineering Program (ENEE)

Professor and Chair: Destler

Professors: Antonsen, Baras, Barbe, Blankenship, Chu, Davis, Davisson, DeClaris, Emad, Ephremides, Frey, Granatstein, Harger, Hochuli, Ja'Ja`, Krishnaprasad, Lee,

Levine, Ligomenides, Mayergoyz, Newcomb, Ott, Peckerar, Rabin, Reiser, Rhee, Striffler, Taylor, Vishkin, Zaki

Associate Professors: Abed, Carter, Chen, Dagenais, Farvardin, Geraniotis, Gligor, Goldhar, Ho, Makowski, Menyuk, Nakajima, Narayan, Oruc, Pugsley, Shamma, Shayman, Silio, Tits, Tretter

Assistant Professors: Chang, Dayawansa, Fuja, Goldsman, Greenberg, Iliadis, Lawson, Menezes, Milchberg, Papamarcou, Yang

The Electrical Engineering Department offers graduate study leading to the Master of Science and Doctor of Philosophy degrees. A diverse offering of courses, seminars, colloquia and thesis guidance encompasses a broad spectrum of topics. Specialization is possible in: (1) communication (random processes; detection, estimation, coding and information theories; digital signal processing; optical communications; communication networks; and remote sensing systems); (2) computers (computer architecture, networking and digital system design; operating systems; and software engineering); (3) control (computer-aided design; nonlinear, sampled data and distributed parameter systems; system optimization; and optimal and stochastic control): (4) electrophysics (electromagnetic theory, plasmas, intense charged-particle beams and applications to accelerators and high-power microwave generation, quantum electronics, millimeter- and microwave-antenna and optical engineering, lasers, nonlinear optics, chemical physics and biophysics); and (5) microelectronics (circuits and devices; VLSI and computer-aided design; microwave and integrated circuits, semiconductor materials; and technology).

Joint programs are maintained with the mathematics, physics and computer science departments and the chemical physics, material science and transportation programs. Opportunities also exist for programs of study in conjunction with many national laboratories and technical facilities. The Department has active theoretical research projects in optical communication, communication networks, coding theory, traffic control, remote sensing, solar energy conversion devices and many other areas.

Employment opportunities for graduates have been exceptionally rich in recent years. Private industry, research laboratories, government agencies and labs, and academic institutions have been hiring at virtually unprecedented rates. This strong demand should continue through the coming decade. The accompanying salary scales have been and should continue to be very attractive. The growing demand for engineering faculty has created a large number of opportunities for those interested in teaching careers.

Admission and Degree Requirements

For admission to electrical engineering, students must possess at least an undergraduate degree from an ABET accredited undergraduate program in electrical engineering with a B+ or better grade point average, or similar undergraduate preparation in mathematics, computer science, physics or other areas of engineering or science.

Requirements for the master's thesis and non-thesis options are those of the Graduate School and must be completed within five years. In addition, students must have an average of B or better in all courses counted toward the degree.

For the Ph.D. degree, students must complete a minimum of 42 semester hours of graduate approved courses with a B average or better, the Ph.D. qualifying examination and all dissertation and oral examination requirements.

Facilities and Special Resources

Modern research and project laboratories in the Department support a wide variety of research, including a microprocessor development laboratory, a gas laser laboratory (He-Ne and CO2 laser stability and lifetime studies and applications), quantum electronics laboratories (nonlinear optics, laser sensors, molecular energy transfer processes and laser millimeter wave systems), an electromagnetic laboratory (millimeter and microwave systems and interactions and dielectrometry), a semiconductor research laboratory with a clean room and a complete set of characterization equipment and techniques, and a charged-particle beam laboratory that includes four intense relativistic electron beam facilities as well as state-of-the-art equipment for vacuum component processing. The Electrical Engineering Department has extensive computer facilities to support its computational needs. These include two advanced computer laboratories, a Solbourne 2-processor SPARC 500 computer, distributed SUN workstations in faculty offices and PC laboratories. The Solarium advanced computer laboratory houses two UNIX-TCP/IP-based SUN 3/60-M-8 servers, 20 SUN 350 and 360 workstations, several laser and line printers. The SRC advanced computer laboratory houses one SUN 3/180 server, one Macintosh II file server, six SUN 3/50 workstations, one SUN 3/110, a NeXT computer and three laser printers. The software support for the machines housed in these two laboratories includes numerous language compilers, CAD analysis programs, graphics libraries and text processing systems. The EE Fulcrum laboratory has 10 IBM PC-AT computers and two dot matrix computers The EE PC laboratory has 15 Zenith PCs and six dot matrix printers. These PCs support C, Pascal and Prolog among other languages. The department also has access to IBM 3081, 4381, UNISYS 1100/92 and three DEC mainframe computers and numerous SUN, Macintosh, IBM and DEC workstations that are housed in the academic computing center on campus. In addition, the faculty and students who are affiliated with the University of Maryland Institute for Advanced Computer Studies have access to a Connection Machine that is housed in the institute. The communications and signal processing laboratory has a Masscomp 5500 computer and an IIS S575 image processing system. A complete engineering library is housed nearby in conjunction with the mathematics, computer and physical science collections.

Financial Assistance

Financial aid is available to graduate students in the form of research assistantships, teaching assistantships and fellowships. Applications for research and teaching assistantships should be completed and sent to the Electrical Engineering Office of Graduate Studies.

Research assistantships are awarded subject to availability of funds and are renewed subject to satisfactory research progress. Summer appointments are often available.

Teaching assistantships are usually awarded in April. Preference is given to United States citizens. Duties may include laboratory teaching assignments, assistance in the computation facility or assistance in courses. Teaching assistants must register for at least nine credit hours per semester.

Fellowships are available for highly qualified applicants in a number of areas.

Local industries and government agencies have work-study programs in which some of the Electrical Engineering graduate student body participates. Application should be made directly to the agencies.

Additional Information

Special brochures or publications offered by the Department may be obtained by contacting:

Electrical Engineering Office of Graduate Studies
University of Maryland
College Park, MD 20742
(301) 405-3681

For courses, see code ENEE.

Engineering Materials Program (ENMA)

Professor and Director: Wuttig[1]

Professor and Dean: Dieter[2]

Professor and Department Chair: Roush[1]

Professors: Armstrong[3], Arsenault[1]

Assistant Professors: Ankem[1], Salamanca-Riba[1], Lloyd[1]

[1]Chemical and Nuclear Engineering
[2]College of Engineering
[3]Mechanical Engineering

The Engineering Materials Program is administered by the Department of Chemical and Nuclear Engineering. Special areas of concentration include diffraction, dislocation and mechanical behavior of materials, x-ray and electron microscopic techniques, electronic and magnetic behavior of materials and of thin films, phase transformations, the chemical physics of materials, and the properties and behavior of polymeric materials.

Admission and Degree Information

The Program offers graduate study leading to the Master of Science and Doctor of Philosophy degrees and is open to qualified students holding a bachelor's degree in any of the engineering and science areas from accredited programs. In some cases it may be necessary to require courses to fulfill this background. The M.S. program offers both a thesis or non-thesis option. The Ph.D. program requires at least three years of full-time study beyond the B.S. degree. All students seeking graduate degrees in Engineering Materials must enroll in ENMA 650, 660 and 671. In addition to Graduate School admission requirements, the Department outlines special degree requirements its departmental publications.

Facilities and Special Resources

Special equipment includes scanning and transmission, electron microscopes, x-ray diffraction equipment, crystal growing, sample preparation and mechanical testing facilities, and high pressure and cryogenic equipment.

Additional Information

Information is available from:

Director
Engineering Materials Program
Department of Chemical and Nuclear Engineering
University of Maryland
College Park, MD 20742

(301) 405-5207
For courses, see code ENMA.

English Language and Literature Program (ENGL)

Professor and Chair: David

Professors: Bryer, Coletti, Cross, David, Freedman, Holton, Howard, Isaacs, Jellema, Kornblatt, Lawson, Miller, Panichas, Peterson, Plumly, Russell, Salamanca, Schoenbaum, Trousdale, Vitzthum, Winton, Wyatt

Associate Professors: Auerbach, Auchard, Barry, Beauchamp, Bennett, Birdsall, Caramello, Carretta, Cartwright, Cate, Coleman, Collier, Coogan, Dobin, Donawerth, Fahnestock, Flieger, Fraistat, Fry, Grossman, D. Hamilton, G. Hamilton, Hammond, Handelman, Herman, Kauffman, Kleine, Lanser, Leinwand, Leonardi, Levine, Loizeaux, Mack, Marcuse, Norman, Pearson, Peterson, Robinson, Wilson

Assistant Professors: Grant-Davie, James, Levin, Moser, Rutherford, Smith, Van Egmond, Wang

The Department of English offers graduate study leading to the Master of Arts and Doctor of Philosophy degrees with areas of specialization in English and American literature. The Department also offers a Master of Fine Arts degree in Creative Writing. In addition, candidates for the M.A. degree may take a minor in composition and rhetoric. Traditionally, most students enrolled in graduate programs in English Language and Literature have sought employment in post- secondary teaching. An increasing number of students are also seeking non- academic employment now in publishing, business and technical writing, administration and personnel management. For the student who decides to seek one of these alternatives, the University of Maryland offers a Career Development Center that helps place students in careers suitable to their interests and to their level of educational achievement.

Admission and Degree Information

In addition to the Graduate School requirements, applicants to the M.A. program should present a 3.4 GPA in English and 24 hours of upper-level English courses. Applicants to the Ph.D. program should present a 3.7 GPA and an M.A. degree in English. All applicants should submit a writing sample to the Office of the Director of Graduate Studies. Applications must be received by January 15 for all programs. Admission is for the fall only.

The M.A. degree requires completion of 30 credit hours and a distribution requirement to assure coverage of the major historical fields. The student may either take 24 hours of course credit and write a thesis for the other six hours, or take 30 hours and pass a written comprehensive examination.

The M.F.A. degree requires completion of 36 hours of coursework. The program balances course requirements between writing workshops and literature courses and offers concentrations in fiction and poetry. A creative thesis (six credits) is also required.

The Ph.D. requires a total of 51 hours of graduate work (normally 21 hours beyond the M.A.) and three further requirements: 1) a two-part exam (written and oral) in the student's two chosen areas of specialization; 2) an examination in a foreign language; and 3) the dissertation.

Applicants to the Ph.D. program must have an M.A. Applicants who wish to pursue a Ph.D. but do not have an M.A. must apply to the M.A. program.

Financial Assistance

A small number of fellowships are awarded by the Graduate School to candidates nominated by the various departments. Most financial aid is in the form of teaching assistantships (three courses of composition per year) that the Department awards in March. About 90 assistantships are currently awarded each year, and about 25 of these go to new students or to others who have not held them previously.

Additional Information

Additional information on admission, financial aid and degree requirements can be obtained from:

David Wyatt
Director of Graduate Studies
Department of English
University of Maryland
College Park, MD 20742
(301) 405-3798

For courses, see code ENGL.

Entomology Program (ENTM)

Professor and Chair: Steinhauer

Professors: Barbosa, Bottrell, Davidson, Denno

Associate Professors: Armstrong, Dively, Hellman, Linduska, Ma, Mitter, Nelson, Raupp, Regier, Reichelderfer, Scott

Assistant Professors: Lamp, O'Brochta

Adjunct Professors: Coddington, Erwin, Ferguson, Gwadze, Hsu, Miller, Raina, Thompson

Professors Emeriti: Bickley, Bissell, Harrison, Haviland, Jones, Menzer, Messersmith, Wood

The Department of Entomology offers both the Master of Science and Doctor of Philosophy degrees. Graduate students may specialize in physiology and morphology, toxicology, biosystematics, ecology and behavior, medical entomology, apiculture, insect pathology, economic entomology, and pest management.

Employment opportunities for graduates exist in industry, academia, federal, state and local governments, and in international and national spheres.

Admission and Degree Information

Students applying for graduate work in entomology are expected to have strong backgrounds in the biological sciences, chemistry and mathematics. An undergraduate degree in entomology is not required, but a strong basic preparation is definitely preferred for admission to the program. Students lacking certain specific courses in their undergraduate program may need to extend the normal period of time required for the degree.

In the M.S. and Ph.D. programs, the student is given latitude in the selection of the advisory study committee, the choice of a major study area and supporting coursework,

and the selection of a research program. The M.S. degree is awarded following the successful completion of the course requirements and a satisfactory thesis. A non-thesis option is also available for those interested in qualifying as pest management specialists; a field experience course including a comprehensive report is substituted for the thesis in this option.

Upon admission to the M.S. or Ph.D. program, the student is given a departmental examination to evaluate general knowledge of biology and entomology. After this examination the student's study committee suggests a program of coursework and approves a detailed research proposal. Following completion of most coursework, the Ph.D. student is given an oral qualifying examination before applying for admission to candidacy.

Facilities and Special Resources

The department maintains facilities for research in all areas of specialization offered. In addition, cooperative programs with other departments in Agriculture and Life Sciences are possible. The department also maintains cooperative research programs with several government agencies such as the Beltsville Agricultural Research Center, the U.S. National Museum of Natural History, and the Walter Reed Army Institute of Research. Students may also participate in the Maryland Center for Systematic Entomology where cooperative guidance toward advanced degrees has been established between the department and scientists in the Insect Identification and Beneficial Insect Introduction Institute, U.S.D.A. and the Department of Entomology, Smithsonian Institution. Specialized facilities are frequently made available to graduate students in these programs. In many instances graduates of the entomology programs find employment in such government agencies because of the contacts made in these cooperative projects.

Financial Assistance

There are a number of teaching and research assistantships available to entomology graduate students on a competitive basis. Several part-time employment opportunities are available in governmental and private research and developmental laboratories in the area.

Additional Information

The Department's "Guidelines for Graduate Students" gives additional information on the graduate program, including requirements for admission, course requirements, examinations, seminars, and research areas and facilities. Copies are available from:

Department of Entomology
University of Maryland
College Park, MD 20742
(301) 405-3912

For courses, see code ENTM.

Family and Community Development Program (FMCD)

Professor and Chair: Billingsley

Professors: Gaylin, Hanna, Koblinsky

Associate Professors: Anderson, Epstein, Leslie, Myricks, Rubin

Assistant Professors: Churaman, Randolph

Lecturers: Werlinich

The Department of Family and Community Development is devoted to describing, explaining and improving the quality of family life by means of research, education, community outreach and public service. The curriculum places special emphasis upon the family and the community as mediating structures in determining life quality. The approach is holistic, i.e., human ecology. Departmental graduate training prepares students for jobs in research centers, consulting firms, voluntary and non-profit organizations, business enterprises, private practice and federal, state and local governments.

The Department offers a Master of Science degree with individually designed areas of emphasis. These include a working knowledge of the growth of individuals throughout the life span, with particular emphases on inter- generational aspects of family living and the effective delivery of family- oriented services. A curriculum in marriage and family therapy is offered (accredited by the American Association for Marriage and Family Therapy), which draws upon a knowledge of family dynamics and change using the clinical techniques of therapy and consultation. Courses are available for students interested in the processes and methods of change for improving community services that impact upon families. A student may focus on the efficient utilization of available family and community resources, the relationship between available resources and governmental (and private sector) policies, and the development of expanded resources through citizen action. Specializations include management of human service programs, family policy analysis and consumer affairs. The Family Service Center provides clinical services to several hundred families. The Family Research Center is the research facility for the study of family life.

Admission and Degree Information

The Department employs the Graduate School's policies as the criteria for admission to the master's program. In addition, applicants must take the GRE Aptitude Test and have adequate undergraduate preparation in one or more of the following areas: anthropology, economics, geography, family development, planning, political science, psychology, public administration, social work, sociology or urban studies. An upper-level course in elementary statistics at the undergraduate level is required for graduation. Students interested in the marriage and family therapy curriculum must submit a special application form available from the FMCD department.

The master's program is 30 hours with additional hours for those in the marriage and family therapy curriculum. The student may choose either the thesis or non- thesis option. A student who chooses the thesis option must take six credit hours of thesis research while a student who picks the non-thesis option must complete 30 hours of coursework plus oral and written comprehensive examinations.

Financial Assistance

Due to the limited number of available graduate assistantships and the high demand for these positions, application for financial aid should be made prior to April 1 for the fall semester of the coming year.

Additional Information

For further information, contact:

Department of Family and Community Development

University of Maryland
College Park, MD 20742
(301) 405-3672
For courses, see code FMCD.

Fire Protection Engineering (ENFP)

Professor and Chair: Bryan
Assistant Professor: Mowrer
Lecturer: Milke

The Fire Protection Engineering Department offers a diversified program of graduate studies leading to the Master of Science degree. An individual study plan compatible with the student's interest and background is developed between the student and adviser. Two specialized areas involve the courses developed for graduate study. The first area focuses on engineering principles concerned with the fire modeling of the scientific fundamentals of diffusion flame combustion, the mechanics of flame propagation and the techniques of field or zone simulation for the prediction of fire development. The second area of study involves the application of simulation and risk analysis to the predictive and analytical procedures for the quantitative assessment of fire hazards and the probabilities of potential fire incidents.

Admission and Degree Information

The M.S. program is open to qualified students holding the B.S. degree. Full admission may be granted to students with degrees in any of the engineering and physical science areas from accredited programs. In some cases it may be necessary to require undergraduate courses to fulfill the student's background. In addition to the Graduate School requirements, the GRE Aptitude Test may be required.

The M.S. degree program offers both a thesis and a non-thesis option. The Department's admission requirements are included in its publications.

Facilities and Special Resources

The Department provides laboratory facilities for graduate research. The laboratories contain radiant panels, a cone calorimeter and particle obscuration apparatus. The departmental computer laboratory contains PC's, AT's and PS2's. Sun workstations and a DEC-based CAD facility are provided by the College of Engineering. A UNIVAC 1100/92 and an IBM 3081 in the Computer Science Building are available by remote access from the Department Computer Laboratory. Library facilities include one of the most extensive fire protection engineering-related collections in the country. The Department has computerized access to the National Institute for Standards and Technology Center for Fire Research Library through FIREDOC.

Financial Assistance

Financial aid is available in the form of fellowships, and teaching and research assistantships. Research assistantships are awarded subject to the availability of research funds. Professional firms and governmental agencies in the area have work-study programs available to graduate students.

Additional Information

Brochures and publications offered by the Department may be obtained by writing:
Department of Fire Protection Engineering

University of Maryland
College Park, MD 20742
(301) 405-3991
For courses, see code ENFP.

Food Science Program (FDSC)

Professor and Chair: Westhoff

Professors: Bean, Bender, Cook, Heath, Johnson, Keeney (Emeritus), King (Emeritus), Mattick (Emeritus), Quebedeaux, Solomos, Twigg (Emeritus), Vijay, Westhoff, Wheaton, Wiley

Associate Professors: Chai, Doerr, Schlimme, Shehata, Stewart, Wabeck

Assistant Professors: Choi, Kantor, Marshall

The Food Science Program offers the Master of Science and Doctor of Philosophy degrees. The Graduate Program is interdepartmental with faculty representing departments of Agricultural Engineering, Agricultural and Resource Economics, Animal Sciences, Botany, Chemistry, Horticulture, Human Nutrition and Food Systems, Microbiology, Poultry Science and the Sea Food Processing Laboratory of the Environmental and Estuarine Studies Center. Food Science is concerned with all the basic and fundamental principles of the physical, biological and behavioral sciences and engineering to better understand the complex and heterogeneous materials recognized as food. Graduates are needed as food scientists or food technologists by the commercial food manufacturing and packaging industry; by many allied industries such as equipment manufacturers and suppliers to the industry; by government agencies at local, state, national and international levels; and by educational institutions.

Admission and Degree Information

The Program requires all applicants to take the Graduate Record Examination (GRE) Aptitude Test and achieve a minimum combined GRE score of 1500; international students must have a TOEFL score of at least 550. The Program also bases its evaluation for acceptance on the student's academic transcripts, letters of recommendation and professional experience. A background in food science, physical, chemical and biological sciences or engineering is desirable. Under certain conditions, the Food Science Admissions Committee may ask an applicant to come in for a personal interview. Students are only accepted into the program when they meet all necessary requirements and when a research adviser can be identified. The Program Chair may either recommend to admit a student without condition, provisionally (with any of 20 conditions to be fulfilled) or deny admission with reasons stated.

After a student is accepted into the program, he or she is assigned an adviser in accordance with the student's objectives, prior experience, coursework, etc. Within the first semester, students should acquaint themselves with faculty members and their fields of interest in order to form a Guidance Committee chaired by the adviser, which also consists of at least two M.S. or four Ph.D. faculty members. Students must also file an approved program of study by the end of the first year of graduate study, and any changes in the program must be approved by the adviser and the Guidance Committee.

In addition to the Graduate School requirements, students who have a B.S. degree in Food Science or the equivalent must complete a minimum of 30 hours of graduate

credit coursework including a minimum of 12 hours of 600-level courses and above, and three credit hours each in biochemistry and biometrics. Students who enter the program without a background in Food Science may be required to complete more than the minimum number of hours of graduate credit to obtain the M.S. degree. Students must also complete a mandatory colloquium (seminar) for which two presentations for credit must be made during the program of study and any other provisional requirements as necessary.

The M.S. program offers both a thesis and non-thesis option. Students who write a thesis must complete six hours of FDSC 799 in addition to the other program course requirements. Students who choose the non-thesis option must complete all program course requirements and prepare a scholarly paper on a subject approved by the Guidance Committee.

In addition to the Graduate School requirements, the Ph.D. degree requires the completion of a program of study as approved by the Guidance Committee, including a minimum of 12 hours of FDSC 899 credit.

Facilities and Special Resources

Laboratories, pilot plants and equipment are located in the Animal Sciences Center, Holzapfel Hall, H.J. Patterson Hall, Turner Laboratory and Shriver Hall. Facilities are available for experimental processing of fruits, vegetables, poultry, red meat, dairy products and seafood. Additional seafood processing facilities are located off campus. Laboratories are equipped for biochemical, biophysical and microbiological research and include facilities for laboratory animals. Instrumentation includes gas-liquid chromotographs, HPLC, atomic absorption spectrophotometer, rheology and texture measurement instrumentation, electron microscopes, super speed and ultra centrafuges, amino acid analyzers, slope extractor and UF/RO membrane separator, radioisotope counters and automated wet chemical analyzers. A broad range of modern facilities for cell culture, biochemistry and recombinant DNA work are also present. University research farms are available for both plant and animal production studies. Specialized facilities of nearby government and food industry laboratories are available for graduate student research. The Library of Congress, the National Agricultural Library and the National Library of Medicine are within easy access to the University.

Financial Assistance

Teaching and research assistantships are available from the participating departments. These assistantships provide a stipend and remission of fees for up to 10 credit hours per semester. The stipends are increased according to time and progress in the graduate program. Funds from grants and contracts are also available for support of graduate research programs.

Additional Information

Dr. Dennis C. Westhoff
Food Science Program
Animal Sciences Building, Room 2113
University of Maryland
College Park, MD 20742
Telephone: (301) 405-1377

For courses, see code FDSC.

French Language and Literature Program (FRIT)

Professor and Chair: Tarica

Professors: MacBain, Therrien

Associate Professors: Black, Cottenet-Hage, Demaitre, Fink, Joseph, Mossman, Russell, Verdaguer

Assistant Professors: Ancekewicz, Brami, Falvo

The Department of French and Italian prepares students for the Master of Arts and Doctor of Philosophy degrees in French language and literature. The composition of the graduate faculty and the variety of course offerings make it possible for students to specialize in any period or movement of French literature or any aspect of the French language, with the consent of their advisers.

Admission and Degree Information

The M.A. program, which offers both a thesis and non-thesis option, is open to students who have a solid grounding in French language and literature. It is strongly recommended that all applicants take the GRE General Examination.

The students' knowledge of French is screened at the beginning of their first semester through a Language Proficiency Examination. Students usually take four semesters to finish the master's degree, which includes the successful completion of a thesis or a substantial research paper, and a comprehensive examination in French literature, French literature and civilization or French literature and linguistics (a six-hour written examination followed by a one-hour oral examination).

The Ph.D. program is open only to the most highly motivated candidates who give evidence of strong qualifications to pursue an interest in individual research.

All applicants for the Ph.D. program (except M.A. graduates of this Department) must pass a three-part preliminary examination administered at the start of the first semester, consisting of an ***explication de textes,*** an essay and an oral examination before being fully admitted to the program. Then, they must complete a program of seminars related to their field of interest. Finally, they must pass three Qualifying Examinations and a translation examination in a second foreign language before being admitted to candidacy and beginning work on their dissertation.

Facilities and Special Resources

In addition to the University graduate and undergraduate libraries, the Department maintains a reference library. Area research facilities include the Library of Congress and the Folger Library (specializing in 16th, 17th and 18th-century literature). The Department has a chapter of the National Honor Society, Phi Sigma Iota.

Financial Assistance

Financial support is available in the form of fellowships and assistantships. For information contact the Department of French and Italian.

Additional Information

For complete information concerning the Department's requirements set forth in the ***Guide to Graduate Programs in French***, contact:

Department of French and Italian
Language and Literature

University of Maryland
College Park, MD 20742
(301) 405-4024
For courses, see code FRIT.

Geography Program (GEOG)

Professor and Chair: Townshend

Professors: Fonaroff, Wiedel

Associate Professors: Brodsky, Christian, Cirrincione, Goward, Groves, Kearney, Leatherman, Mitchell, Prince, Thompson

Assistant Professor: Marcus

Lecturers: Broome, Chaves, Frieswyk

Affiliate Faculty: Corsi

The Department of Geography offers graduate study leading to the Master of Arts and Doctor of Philosophy degrees. All degree-seeking graduate students are required to complete the following courses during their first full year of study: GEOG 483 (requires non-class time on campus), GEOG 600, GEOG 605, GEOG 610 and all prerequisites associated with these required courses.

Students at both the master's and doctoral levels initiate their own program of coursework and submit a plan of study for approval.

While the Washington job market is highly competitive, employment opportunities in applied geography remain strong. Would-be practicing geographers should stress such marketable studies as remote sensing, cartography, computer cartography, geographic information services, international development and locational analysis.

Admission and Degree Information

Incoming M.A. students are expected to have an undergraduate degree in geography; students from other fields will be required to do additional remedial work. All graduate applicants should submit aptitude test scores of the Graduate Record Examination.

The master's degree program can support specializations in: (1) physical geography — coastal and estuarine environments; (2) urban geography-metropolitan analysis; (3) human geography, especially historical geography; and (4) geographical analysis, including remote sensing, cartography, geographic information systems or spatial analysis (this specialization must be taken in combination with a systematic concentration). Geography internships are encouraged for students in each specialization.

All master's degree students must take at least five courses in one of the four master's-level specialty areas. In addition, each master's student must take a combination of three courses outside the specialization designed to provide some breadth of knowledge in geography or in a related field. A regional or area studies focus can be taken as part of the three-course non-specialization combination. Master's students must complete at least 38 graduate credit hours. No more than 13 credit hours may be taken at the 400 level.

All master's students take an oral examination defense of a research proposal and a final oral examination based either on the thesis or the first of the two research papers.

The Ph.D. program usually requires three years to complete. The program is designed to meet the individual needs of the student; thus, few courses are required. Doctoral applicants must submit a written statement of study that is used to solicit faculty sponsors. Because of the degree of specialization, the Department only considers Ph.D. applicants whose interests coincide with departmental faculty competence.

The Department normally requires a grade point average higher than 3.0 and a master's degree from a recognized geography department for admission. Competency in terms of fields of study and a comparable level of achievement to the Department's master's degree may also be accepted. Students without a master's degree may petition the Department for admission and may be accepted upon approval of a faculty committee appointed by the Department Chair.

After completion of formal coursework for the Ph.D., students must take a two-part qualifying examination. Part one is a written examination on the student's knowledge of the general field of geography and a specific field of research specialization. Part two is an oral examination evaluating the dissertation proposal. Upon satisfactory completion of the dissertation there is also a final oral examination.

Facilities and Special Resources

Departmental research facilities are contemporary and outstanding. They include cartographic laboratories, a computer mapping and spatial analysis facility, a coastal geomorphology laboratory and remote sensing facilities. Numerous microcomputers are housed in the Department. The Department publishes an Occasional Papers Series.

Additional Information

More detailed information on the M.A. and Ph.D. programs can be obtained from:

Director of Graduate Studies
Department of Geography
1113 Lefrak Hall
University of Maryland
College Park, MD 20742
(301) 405-4057

For courses, see code GEOG.

Dual Master's Degrees Programs in Geographic Information Systems

This is a joint program of the College of Library and Information Services and the Department of Geography. It results in two master's degrees; the Master of Library Science (MLS) and the Master of Arts in Geography. The dual-degree program requires a minimum of 56 graduate credit hours. For a full-time student, the program requires two years of intensive study. Admission to the program is competitive and students must apply separately and be admitted both to Library and Information Services and to Geography. Contact either the Department of Geography (301) 405-4057 or the College of Library and Information Services (301) 405-2038 for more information.

Geology Program (GEOL)

Professor and Chair: Brown

Professor: Chang

Associate Professors: Candela, McLellan, Ridky, Segovia, Siegrist, Stifel, Wylie

The Department of Geology offers graduate study leading to the Master of Science and Doctor of Philosophy degrees. Broad research interests among faculty members make study and research available in all major fields of geological sciences with specialization in economic geology, mineralogy; environmental geology; hydrology, petrology; crystal chemistry; geochemistry; sedimentation; stratigraphy; paleontology; structural geology; and tectonics.

Admission and Degree Information

Qualified students with a major in geology as well as in physics, chemistry, biology and related sciences and engineering are invited to apply for admission to the graduate programs. All students must submit the GRE General Aptitude Test scores to be considered for admission, and the GRE Advanced Test in Geology is recommended but not required. There is no single prescribed curriculum for all graduate students. The entire course of study is individually developed for each student by his/her graduate program committee. All students are required to take an entrance examination, results from which are used to design their academic schedules.

The M.S. degree is awarded following the successful completion of the course requirements and a satisfactory thesis. For the Ph.D. degree, requirements include satisfactory coursework, an oral candidacy examination, a research proposal and a successful dissertation defense.

Facilities and Special Resources

The Department has all standard laboratory equipment for rock, mineral, and fossil preparation and treatment. Special equipment includes a fully automated x-ray spectrometer; an electron microprobe analyzer; x-ray diffractometers; atomic absorption spectrophotometer; research transmitted and reflected light microscopes; geophysical equipment of magnetic, seismic, resistivity and EM measurements; and a complete laboratory for mineral synthesis and phase equilibrium studies at high temperatures and high pressures including hydrothermal, internally heated piston-cylinder and Bridgman opposed-anvil systems. Extensive library, computer and electron microscope facilities are available on campus for graduate research.

The campus is located within the Washington D.C. metropolitan area and close to Baltimore where a large number of outstanding institutions are located. These include the United States Geological Survey, Bureau of Mines, Department of Energy, Environmental Protection Agency, National Institute of Technology and Standards, NASA's Goddard Space Flight Center, the Smithsonian Institution, the Carnegie Institute's Geophysical Laboratory and Department of Terrestrial Magnetism and the Geological Survey of Maryland. Opportunities exist for programs of study in cooperation with many of these institutions.

Financial Assistance

Graduate students are eligible for Departmental teaching assistantships, Graduate School fellowships and grant-supported fellowships and research assistantships. In addition, some curatorial, library and other part-time work is available.

Additional Information

The Department's "Graduate Programs in Geology at Maryland" gives additional information on the requirements, examinations, faculty research interests and publications, research facilities and financial aids. Copies are available from:

Department of Geology
University of Maryland
College Park, MD 20742
(301) 405-4365

For courses, see code GEOL.

Germanic Language and Literature Program (GERS)

Professor and Chair: Pfister

Professors: Beicken, Best, Herin (Emeritus), Jones (Emeritus), Oster, Pfister

Associate Professors: Bilik, Fleck, Frederiksen

Assistant Professors: Fagan, Richter, Strauch

The Germanic Section of the Department of Germanic and Slavic Languages and Literatures offers programs of study leading to the M.A. and Ph.D. degrees. Specialization includes the following areas: Language Pedagogy and Applied Linguistics; Germanic Philology; Medieval Literature and Culture; and Literature of the German Speaking Countries from the Renaissance to the Present.

Admission and Degree Information

In addition to the Graduate School requirements, candidates should have a bachelor's degree with a major in German language and literature or the equivalent and fluency in the written and spoken language. Candidates for the doctorate must have a master's degree in German or in a related discipline such as Germanic Studies, Scandinavian Studies, Language Education, Medieval Studies, etc.

The M.A. degree program offers both a thesis and non-thesis option. For the thesis option, the student must complete 24 hours of coursework, the thesis and a written comprehensive examination. The non-thesis option requires 30 hours of coursework, a mini-thesis with oral defense and a written comprehensive examination. For both options the comprehensives consist of four two-hour examinations based on the coursework and the M.A. Reading List.

Degree requirements for the Ph.D. are as follows: 1) completion of at least 30 hours of coursework beyond the master's degree over a period of at least one year at the University of Maryland and a further 12 hours of dissertation research; 2) a reading skill examination in a language other than English or German, which may be another Germanic language or a language related to the candidate's research; 3) comprehensive written examinations; 4) presentation of the dissertation topic to the Germanic Section graduate faculty before the topic is approved; and 5) the comprehensive examinations.

Facilities and Special Resources

In addition to its course offerings listed below, the Germanic Section of the Department of Germanic and Slavic Languages and Literatures sponsors the German Club, the University of Maryland Chapter of Delta Phi Alpha (the national German language honors society). Distinguished scholars and lecturers, as well as visiting pro-

fessors, visit the metropolitan area and campus regularly. College Park's proximity to Washington, D.C. facilitates participation in the many cultural functions of the capital with its wealth of German and Scandinavian social groups and national societies.

Financial Assistance

The Germanic Section offers graduate teaching and non-teaching assistantships as well as several fellowships.

Additional Information

For further information write to:
Director of Graduate Studies
Department of Germanic and Slavic Languages and Literature
University of Maryland
College Park, MD 20742
(301) 405-4091
For courses, see code GERS.

Government and Politics Program (GVPT)

Professor and Chair: Quester

Professors: Azar, Butterworth, Claude, Davidson, Dawisha, Elkin, Glass, Gurr, Hsueh, Marando, McNelly, Oppenheimer, Phillips, Piper, Pirages, Reeves, Segal, Stone, Uslaner, Wilkenfeld

Associate Professors: Alford, Glendening, Heisler, McCarrick, McIntosh, Ranald, Soltan, Terchek

Assistant Professors: Haufler, Herrnson, Kaminski, Lalman, Lanning, Swistak, Tismaneanu

The Department of Government and Politics is a large and diverse department that offers graduate study leading to both the Master of Arts and the Doctor of Philosophy degrees in political science. The Department offers a variety of courses and program flexibility for students seeking academic careers as well as those seeking other professional career interests in political science.

This diversity and flexibility enables students to pursue specializations in the broad fields of American politics, international relations, comparative politics, political economy and political theory. In addition, students may pursue in depth more specialized fields such as formal theory, public administration, public law, Soviet-East European studies, national security, East Asian studies, political development, public policy, political behavior, political psychology, conflict management, politics of advanced industrial societies and social choice.

In addition to this coursework, students also participate in the activities of the Public Service Intern Program, Project ICONS, the Center for International Development and Conflict Management, the Maryland Social Choice Program and the Center for International Security Studies at Maryland.

Admission and Degree Information

Admission to both the M.A. and Ph.D. programs is competitive; the Department seeks to recruit highly qualified students and to admit the strongest students from the pool of applicants. Approximately 30-40 students enter graduate programs each year.

Students seeking admission to the M.A. program who have an undergraduate GPA of at least 3.2 and aggregate GRE scores of about 1600 are within the competitive range. Admission to the doctoral program is even more restrictive and competitive than at the master's level.

The M.A. program provides substantial flexibility to students and can generally be completed in three semesters of full-time study. It is a useful degree for those with career interests in public service or the private sector and is the first degree for those seeking an academic career.

Master's degree candidates may select a thesis or a non-thesis option, both of which require six semester hours of political theory or political philosophy, six semester hours of methods courses and a comprehensive examination in one field. Both options require a total of 30 semester hours of credit.

The doctoral program is intended to provide students with the knowledge, methodological skills and research experience appropriate for persons who intend to enter the discipline of political science. Once students are admitted to the program, they are expected to complete 42 hours of graduate work including courses in political theory and methods that are required for all students. Under an adviser's direction, students will identify two fields of specialization and must pass comprehensive written examinations in both fields and complete a dissertation.

Financial Assistance

In addition to teaching assistantships, the Department also has a government internship program for students interested in public administration. There are also a limited and variable number of research positions available through research grants.

Additional Information

Further information and a manual on graduate study can be secured from:

Director of Graduate Studies
Department of Government and Politics
University of Maryland
College Park, MD 20742
(301) 405-4161

For courses, see code GVPT.

Health Education Program (HLTH)

Professor and Chair: Gilbert

Professors: Burt, Feldman, Gold, Greenberg, Leviton, Wilson

Associate Professors: Allen, Beck, Clearwater, Miller

Assistant Professors: Alexander, Desmond, Klos, Thomas

Adjunct Professors: Schaeffer, Valente

Affiliate Professor: Bridwell

The Department of Health Education offers a program designed to prepare students to enter health education and related health professions in teaching, research, consulting and administrative roles. Career opportunities for graduates include professional education, research, health maintenance, public schools, community health agencies, health care delivery and promotion, and private and governmental consulting settings.

Admissions and Degree Information

The Department offers graduate study leading to the Master of Arts and Doctor of Philosophy degrees. The master's program offers both thesis and non-thesis options.

The Department offers fully developed tracks of study and some field experience in several areas, including stress management, worksite health promotion, health behavior, safety education, school health education, sexuality, drug education, community health and others. Advanced degree study is not limited to these areas. Each student, in consultation with the Director of Graduate Studies and the appropriate faculty member, designs an individual program of study to meet his/her projected professional needs.

Students who hold at least a bachelor's degree in areas related to the social, psychological or biological basis of human health will be considered for admission to the M.A. program. Ph.D. applicants must have completed work on an appropriate master's level degree. Entrance requirements also include an undergraduate GPA of at least 3.0 and a graduate GPA of 3.5, satisfactory GRE scores (quantitative and verbal sections) and letters of recommendation.

Facilities and Special Resources

The student may experience specific application of theory through numerous field studies and departmental service programs in the areas of controlling stress and tension, children's health and development, programs for the aged, weight control, women's health and safety education. Special departmental facilities include the Psychophysiological Research Laboratory, the Minority Health Research Laboratory, the Interdisciplinary Health Research Laboratory, the Safety Education Center and a college microcomputer laboratory.

The proximity of the National Institutes of Health, the National Library of Medicine and the Library of Congress render the University of Maryland unusually well suited for graduate work in health education.

Financial Assistance

The Department offers a limited number of graduate teaching and research assistantships. The Department may also recommend outstanding applicants to the Graduate School for University fellowships.

Additional Information

For more specific information on the program, contact:

Dr. Robert S. Gold
Director of Graduate Studies
Department of Health Education
University of Maryland
College Park, MD 20742
(301) 405-2464

For courses, see code HLTH.

Hearing and Speech Sciences Program (HESP)

Professor and Acting Chair: McCall

Professor: Yeni-Komshian

Associate Professors: Baker, Dingwall, Gordon-Salant, Ratner, Roth
Professor Emeritus: Newby

Admission and Degree Information

The Department of Hearing and Speech Sciences offers the Master of Arts degree with either the thesis or the non-thesis option and with major emphasis either in speech and language pathology or in audiology. The Master's degree is required for individuals preparing for positions as speech pathologists or audiologists in schools, hospitals, rehabilitation facilities, hearing and speech centers or in other clinical settings. Academic coursework is combined with supervised clinical practice in the University Speech and Hearing Clinic and in selected outside clinical facilities so that the graduate will meet the academic requirements for clinical certification by the American Speech and Hearing Association and for licensing in the State of Maryland. The Master's degree program is accredited by the American Boards of Examiners in Speech Pathology and Audiology.

Applicants with an undergraduate degree in the hearing and speech sciences or a related field are considered for admission to the M.A. degree program, which usually requires two years of graduate study. Individuals without a background in the hearing and speech sciences may need more than two years to finish. Only full-time students are admitted to the program.

The Department also offers the Doctor of Philosophy degree with a major emphasis in speech, language or hearing. Students with a B.A. or M.A. are considered for admission to the doctoral program. Matriculated doctoral students will choose within their major a special interest area, which may focus on the normal aspects of their major or disorders related to the major. A student must also select a minor area of study either from within or outside departmental offerings. There are no foreign language requirements, but advanced courses in statistics and experimental research design are required for the degree. Course programs are planned by the student and a committee of at least four faculty members. All doctoral students are expected to participate for academic credit in varied research activities within the Department. Students must take written and oral comprehensive examinations for admission to candidacy after completing formal academic coursework. Doctoral students must register for at least 12 semester hours of dissertation research credit before completing the degree.

In addition to the Graduate School requirements, the Department requires applicants to furnish scores on the Graduate Record Examination Aptitude Test. Prospective applicants should note that decisions on summer and fall admissions are made in early March and on spring admission in early November. Early application is encouraged.

Facilities and Special Resources

The Department's facilities include: (1) several modern research laboratories equipped to support research in the areas of language, acoustic phonetics, physiological phonetics, psychoacoustics, speech perception, neuropsychology and brain stem evoked response audiometry; (2) an integrated audiovisual laboratory; (3) a departmental library; and (4) a hearing and speech clinic that includes several audiological test suites and diagnostic/therapy rooms equipped for observation. Additional research and clinical facilities are available in the Washington and Baltimore metropolitan areas. The Library of Congress, the National Library of Medicine and the libraries of various medical

schools in the Washington-Baltimore area supplement the University's libraries at College Park.

Financial Assistance

A limited number of graduate assistantships are available through the Department. Assistantships that carry teaching, research or clinical responsibilities are awarded on a competitive basis.

Additional Information

Additional information about the M.A. and Ph.D. programs may be obtained by contacting:

Chairman
Department of Hearing and Speech Sciences
University of Maryland
College Park, MD 20742
(301) 405-4214

For courses, see code HESP.

History Program (HIST)

Professor and Chair: Price

Professors: Belz, Berlin, Brush[1], Callcott, Cockburn, Cole, Cooperman, Foust, Gilbert, Haber, Harlan, Kent, Lampe, McCusker, A. Olson, K. Olson, Price, Smith, Sparks, Warren, Yaney

Associate Professors: Bedos-Rezak, Breslow, Darden[3], Eckstein, Farrell[2], Flack, Flynn, Friedel, Grimsted, Gullickson, Harris, Hoffman, Holum, Kaufman, Majeska, Matossian, Mayo, Moss, Perinbaum, Ridgway, Rozenbilt, Spiegel, Stowasser, Sumida, Wright, Zilfi

Assistant Professors: Bradbury, Nicklason, Thompson, Williams

[1]Joint appointment with Institute for Physical Sciences and Technology
[2]Joint appointment with Secondary Education
[3]Joint appointment with Philosophy

The Department of History offers programs leading to the degrees of Master of Arts and Doctor of Philosophy. Areas of specialization include: United States, Ancient, Medieval, Early Modern European, Modern European, British, Russian, Latin American, African*, Middle Eastern*, East Asian, Diplomatic, Economic, Science and Women's History

*Fields at M.A. level only.

Admission and Degree Information

The Master of Arts degree serves both as a firm grounding in a field of history for teaching purposes and as preparation for the pursuit of the doctorate. In addition to the Graduate School requirements, the GRE aptitude test is required. An undergraduate major in history is not required for admission. Thirty credit hours are required for the degree.

The Department offers both a thesis and a non-thesis option. Departmental requirements for the degree include one section of a general seminar (American, European or Comparative World History) and two 800-level research seminars. A maximum of

nine hours of credit may be taken in 400-level courses. For those students who select a thesis option, six hours of M.A. thesis research courses (HIST 799) are required. There will be a final oral examination confined to the thesis and the area in which it lies. Students who select the non-thesis option must take 30 credits (15 in the major field, nine in the minor field and six hours of electives), submit two scholarly papers to their examining committee and pass a four-hour comprehensive examination in their major area.

The student's M.A. examining committee will decide whether a student will be admitted to the doctoral program on the basis of the his or her record of achievement in coursework, a written examination (if required in the student's major area), and a thesis and oral defense of the thesis or two submitted research papers. Students with M.A. degrees awarded at other institutions will be asked to submit substantial evidence of their written work when they apply for admission to the doctoral program. Doctoral candidates must complete three sections of the General Seminar. Within five semesters after entering the doctoral program, every student must pass a general oral and a special field written examination in his or her major area and one written field examination in a minor area. These examinations will test for a broad, intelligent and informed handling of the major historical problems and literature of that field.

An oral examination on the student's dissertation prospectus and a bibliography on the dissertation field are required. The dissertation is to be understood to constitute the largest single portion of the doctoral program; it is expected to be a distinct contribution to historical knowledge and/or interpretation.

All doctoral students must show a reading competence in one foreign language.

Facilities and Special Resources

In addition to the field concentrations described above, the Department of History offers several forms of specialized training. In the field of historical editing the Department has introduced a successful internship course in archival work in conjunction with the National Archives. Since 1970, the Department has sponsored a journal of history, ***The Maryland Historian,*** which features scholarly articles and reviews and provides practical experience for graduate students in the production of a journal. The journal was founded and is managed and produced by graduate students in the Department of History. The Department also sponsors major editorial projects: the *Booker T. Washington Papers*, the *Samuel Gompers Papers*, the Freedom and Southern Society project, and the *Charles Carroll of Carrollton Papers*. A number of history department graduate students have gained valuable research and editing experience on these projects, all of which receive support from the National Historical Publications and Records Commission. In conjunction with the Department of Philosophy, the Department of History sponsors and participates in the Folger Institute of Renaissance and Eighteenth-Century Studies. The Institute offers seminars, workshops, conferences, colloquia and lectures for graduate students and faculty. The Institute also awards fellowships to graduate students, and several of these awards have gone to doctoral candidates from the University of Maryland's history department. The Department of History also participates in the Caesarea excavations. This project provides a rich source of thesis and dissertation topics for graduate students in Ancient History.

Financial Assistance

The Department offers financial assistance principally in the form of teaching assistantships to outstanding graduate students. These positions vary in number according

to the availability of funds, but generally about 38 are awarded to students working toward the Ph.D. or M.A. degree. Appointment as a teaching assistant provides students an opportunity to work closely with faculty members in the teaching of undergraduate survey courses in history. Paid internships at regional historical institutions that carry tuition scholarships are also available.

Additional Information

For complete descriptions of programs and requirements, contact:

Chair
Department of History
University of Maryland
College Park, MD 20742
(301) 405-4264

For courses, see code HIST.

Concentration in the History and Philosophy of Science

The Committee on the History and Philosophy of Science supervises graduate study leading to the Master of Arts and Doctor of Philosophy degrees in History or Philosophy. Courses are offered in a wide range of subjects in the history and philosophy of science and technology, and research facilities are available on the College Park campus and in the Washington area. For advanced research, the emphasis is on the history and philosophy of physical and biological science in the 19th and 20th centuries; history of the philosophy of science and scientific ideas; genetics, computer science, geophysics and astronomy; and scientific institutions in the United States. Integration of historical and philosophical interpretations of science is stressed in both teaching and research.

While academia is the traditional employer of historians and philosophers of science, other opportunities exist with museums, government and industry. Academic opportunities for historians and philosophers of science recently have been more plentiful than for historians or philosophers in general. While the numbers are small, the Committee has successfully placed all of its degree recipients.

Students should apply for admission to either the History Department or the Philosophy Department, indicating History and Philosophy of Science as the field of specialization. Since people with diverse backgrounds can be successful in this field, there are no rigid requirements for admission; the quality of a student's work in science, history and philosophy, as demonstrated not only by grades and test scores but also by papers and independent projects, is more important than the number of credit hours in these subjects. But prospective students should also be warned that the minimum requirement for doing research in the history and philosophy of science covers substantially more areas than normally expected of Ph.D.'s in any one of the traditional fields of history, philosophy or a science; it includes training in a science equivalent to a B.S. (preferably M.S.) degree, proficiency in both oral and written expression and an ability to read at least one foreign language (preferably both French and German).

The Committee also encourages applications from students who do not intend to obtain a Ph.D. in history and philosophy of science but desire only the M.A. as preparation for careers in science, teaching, government service, technical administration, museum work, etc., or who plan to proceed to the Ph.D. in another field.

A few teaching assistantships are available in the History and Philosophy Departments for students who have adequate backgrounds in those subjects.

Detailed information may be obtained by writing to:

Chairperson
Committee on the History and Philosophy of Science
1131 Skinner Building
University of Maryland
College Park, MD 20742

For courses, see code HIST.

Studies Leading to the M.A. in History and the M.L.S.

The Department of History and the College of Library and Information Services coordinate two master's degree programs to meet the need for multi-disciplinary graduate training for archivists, records managers, manuscript curators, rare book librarians, bibliographers, conservation administrators and those wishing to become subject and research specialists in academic, special and/or research libraries. Because of the campus' proximity to a variety of immensely rich research collections, students are able to gain first-hand experiences through internships that reinforce their classroom instruction.

The sequence of courses leading to the two degrees prepares students to understand the intellectual approach of the research scholar through historic training and to meet those research needs through the information services offered in CLIS. The coordinated curricula provide four main options: 1) archives and records managements; 2) curatorship of historical collections; 3) scholarly editing and publishing; and 4) reference research and bibliographic services. The 54 hours required for the degrees combine 24 hours in each component plus six elective hours. The M.A.-M.L.S. is a non-thesis program, but students may choose to write a thesis when such research enhances their program.

Admission and Degree Information

Students may apply for admission under the rubric HILS (History-Library Science) either through the Department of History or CLIS. Each has a coordinator who serves as a student adviser. Since many of these courses are offered in sequence, it is important for students to work closely with these advisers. The two degrees are awarded simultaneously, and a student who fails to complete the special requirements for the coordinated degree programs may not receive either degree. If students subsequently wish to receive only one degree, they must transfer from HILS either to the graduate program in History (HIST) or to the College of Library and Information Services (LBSC) and fulfill the normal requirements for the separate M.L.S.

Financial Assistance

A few teaching assistantships are available in the Department of History, and the College of Library and Information Services has some research assistantships and fellowship aid for students in this course of directed study. These are awarded on a competitive basis in both components.

Additional Information

Detailed information may be obtained by writing to the HILS Coordinator, in either the Department of History or the College of Library and Information Services.

For courses, see code HIST.

Horticulture Program (HORT)

Professor and Acting Chair: Gouin

Professors: Kennedy, Oliver, Quebedeaux, Solomos, Wiley

Adjunct Professor: Anderson, Galletta, Gross, Kretchmer, Krizek

Professors Emeriti: Link, Scott, Shanks, Stark, Thompson, Twigg

Associate Professors: Beste, Bouwkamp, Deitzer, Gould, McClurg, Ng, Schales, Schlimme, Swartz, Walsh

Assistant Professors: Graves, Hamed, Healy, Hershey, Scarfo, Stutte

Lecturer: Mityga

The Department of Horticulture offers graduate study leading to the Master of Science and Doctor of Philosophy degrees. The M.S. degree program offers both a thesis and non-thesis option. Candidates place major emphasis in the areas of fruit, vegetable or ornamental crops, or environmental and landscape horticulture. Within these commodity areas students may direct their studies and research efforts to mineral nutrition, postharvest physiology, genetics and breeding, genetic engineering, chemical growth regulation, water relations, tissue culture, plant propagation, histochemistry, photoperiodism and other factors affecting production, postharvest handling and preservation of horticultural crops. The research activities required for the thesis or dissertation are normally carried out in conjunction with the research programs of the Departmental staff.

The candidate's program may be directed toward a career in research, teaching, extension education or industry. Many recent graduates are currently involved in programs at major universities; others are teaching at the vocational agriculture and community college level. Still others are employed as county agents or specialists with the Cooperative Extension Service or work in research and development with the U.S. Government, private industry or international agriculture.

Admission and Degree Information

Students who seek admission should show undergraduate preparation in horticulture, botany, chemistry and supporting agricultural disciplines. Those without this background are advised to enroll as undergraduate students to correct these deficiencies. Students entering the doctoral program should have or plan on completing a M.S. degree in Horticulture, although presentation of the M.S. in a related plant science field may be acceptable. The Graduate Record Examination Aptitude Test is required.

A graduate student is assigned a temporary adviser upon admission and arrival. During the first semester the student will select a major adviser, and an advisory committee will be appointed. This committee will help the candidate develop a program of courses and research to meet his or her goals and aspirations. A comprehensive, oral examination is given each candidate for the M.S.; candidates for the Ph.D. take an oral qualifying examination as well as a final oral exam covering the dissertation.

Facilities and Special Resources

The College Park campus offers modern laboratory and greenhouse facilities in which instrumentation provides for chromatography, spectrophotometry, elemental analysis,

histology, biotechnology and other procedures. A system for automatically monitoring respiratory gases and volatiles is available in connection with controlled atmosphere chambers. Controlled-temperature storage and growth chambers provide facilities for postharvest and environmental control studies. A large tissue culture lab has been approved for transformation research in plants. Greenhouse and plot areas are available for research with floricultural and ornamental plants. Orchards for research with fruits are located at the Wye and Western Maryland Research and Education Centers; other research studies are conducted cooperatively with fruit growers in the western part of the state. Field research with vegetable crops is carried on at the Lower Eastern Shore Research and Education Center in Salisbury, and with fruit and vegetable crops at both the Wye Research and Education Center in Queenstown and the Central Maryland Research and Education Center in Upper Marlboro.

The Beltsville Agricultural Research Center of the U.S. Department of Agriculture, located three miles from the campus, provides opportunities to attend seminars, conferences and workshops, and to conduct cooperative research with the USDA Beltsville ARS Center scientists. In addition, the National Agricultural Library at the Research Center is available to graduate students and faculty.

Financial Assistance

Some graduate students are supported with financial aid. Research and teaching assistantships are offered on a competitive basis to students on full admission status, as available. All graduate assistants are expected to assist in the teaching program of the Department, and those in the M.S. program will follow the thesis option.

Additional Information

For more specific information, please contact:

Chair
Department of Horticulture
1124 Holzapfel Hall
University of Maryland
College Park, MD 20742
(301) 405-4264

For courses, see code HORT.

Human Development Education Program (Institute for Child Study) (EDHD)

Professor and Chair: Hardy

Professors: Eliot, Porges, Seefeldt, Torney-Purta

Professors Emeriti: Bowie, Dittman, Goering, Grambs, Hatfield, Morgan

Associate Professors: Bennett, Flatter, Fox, Gardner, Huebner, Koopman, Marcus, Robertson-Tchabo, Tyler

Assistant Professors: Byrnes, Green, Holloway, Hunt, Taylor, Wigfield

The interdisciplinary programs of the Department of Human Development/Institute for Child Study attempt to collect, interpret, and synthesize the findings of the human sciences that are concerned with human growth, lifespan development, and learning, and to communicate this synthesis to persons who need such understandings as a basis for their practice and planning. Courses are psychological in nature and are intended

to increase the student's understanding of learning theory and cognitive, social, and emotional development. Research thrusts are primarily concerned with the social aspects of human development.

Admission and Degree Information

The Department of Human Development/Institute for Child Study offers graduate programs leading to Master of Education, Master of Arts with thesis, Master of Arts without thesis. Doctor of Philosophy, and Doctor of Education degrees, and Advanced Graduate Specialist Certificate (a planned program of 30 graduate hours beyond the master's degree). Admission requirements for the master's program requires a 3.0 undergraduate grade point average and the submission of the Miller Analogies Test or the Graduate Record Examination test scores. Admission to an A.G.S. or Doctoral program requires a 3.5 grade point average in previous graduate studies and either a 3.0 undergraduate grade point average or at least a 40 percentile on the Miller Analogies Test or Graduate Record Examination. The research oriented M.A. and Ph.D. degree programs in human development are designed to develop student competencies in the theoretical areas of biological, psychological, learning, and sociocultural processes, and related research methods in human development. The practice oriented M.Ed., M.A. without thesis, and Ed.D. programs are designed to develop student competencies in identifying the implications of scientific knowledge for specific situations through training in program design, management, delivery, and evaluation of human services consistent with current scientific knowledge of human development.

The primary thrust of Department/Institute Programs is focused upon educational institutions and services and secondarily with other human services which might also draw upon scientific knowledge of human growth and development. The graduate program is intended to prepare educational psychologists for service in schools and other community agencies dealing with individuals of all ages, to prepare teachers of human development in higher education, and to prepare research-oriented individuals for service in public (county, state, or federal) or private organizations. A student's program is individually developed through consultation with advisers and appropriate committees to meet the unique needs of the student consistent with the purposes and goals of the Institute for Child Study. A listing of graduate degree requirements is available from the EDHD office.

Facilities and Special Resources

The Washington, D.C. area and the University of Maryland are particularly rich in resources for graduate study in human development. The faculty of the Institute is uniquely multi-disciplinary, representing the broad range of the human sciences and related applied fields. The Institute has ongoing in-service field programs in child and youth study, and opportunities for participating in research. Internship experiences are available through cooperation with various agencies and schools in the area. Resources of the College of Education include a Center for Young Children, a Curriculum Materials Center, an Educational Technology Center, a Reading Center, Science Center, and financial and advisory support services for research and evaluation. In addition, the Institute has two major developmental assessment laboratories and a mobile developmental assessment laboratory through which the student can gain first-hand experience in making assessment of infants and young children.

For courses, see code EDHD.

Human Nutrition and Food Systems (HNFS)

Professor and Chair: Read

Professors: Ahrens, Moser-Veillon, Prather, Sims

Associate Professors: Castonguay, Jackson, Williams

Assistant Professors: Choi, Karahadian, Noble, Taylor

Lecturers: Curtis, Norton

Adjunct Professors: Failla, Hamosh, Reiser, Reynolds, Trout

Adjunct Associate Professors: Bathena, Goldberg, Pao, Szepesi

Adjunct Assistant Professors: Behall, Conway, Deuster, Guenther, Hallfrisch, Michaelis, Miles, Monagan, Nolan, Patterson, Raiten, Sempos

Affiliate Professors: Hansen, Heald

Affiliate Assistant Professors: Kantor, McKenna

NOTE: Some courses in this program may require the use of animals. Please see the Statement on Animal Care and use in the appendix and the policy statement for students under "Degree Requirements."

The Department offers graduate study leading to the Master of Science and Doctor of Philosophy degrees in each of the following major areas: food, nutrition and foodservice administration. The food area includes studies in experimental foods, sensory evaluation and flavor chemistry as well as cultural, behavioral and consumer aspects of food. Nutrition includes the science of nutrition as well as the areas of community, international and clinical nutrition. Foodservice administration includes foodservice systems management. The Department also participates in an interdepartmental program for Master of Science and Doctor of Philosophy degrees in nutritional science, which are described below.

Admission and Degree Information

In addition to minimum Graduate School requirements, a satisfactory score on the aptitude portion of the Graduate Record Examination is required. A minimum combination of 1000 with a minimum of 450 on both the verbal and quantitative sections is required for admission.

The master's degree program offers thesis and non-thesis options in food, nutrition or foodservice administration.

All master's students are required to take a seminar, research methods, and statistics course. Other courses are selected with the guidance of an adviser and/or a committee. Non-thesis option students must prepare a research paper, present an additional seminar and take a written comprehensive examination in addition to an oral examination. An average of three or four semesters is usually required to complete the thesis option and two or three semesters for the non-thesis option.

Students with bachelor's degrees may apply for the doctoral program but they are encouraged to complete requirements for the M.S. degree first. Applicants holding a master's degree with the appropriate background courses may be admitted directly into the doctoral program. Previous graduate work will be evaluated on an individual basis. Written and oral comprehensive examinations are given upon completion of all coursework. A final oral examination is held for the student to defend the dissertation.

Facilities and Special Resources

The Department has well-equipped laboratories for research in all areas of specialization.

The Department also has special arrangements and cooperative agreements with laboratories at the Beltsville Human Nutrition Center, A.R.S., U.S.D.A., the University Affiliated Program in Child Development at Georgetown University Hospital Clinic and University of Maryland Hospital in Baltimore for students in nutrition and foods. Faculty members generally have advanced degrees in the areas of experimental foods and food chemistry, food-related behavior, community nutrition, clinical nutrition, human and animal nutrition and foodservice systems. Adjunct faculty extend these capabilities and resources to laboratories and clinics throughout the Washington-Baltimore area.

Financial Assistance

There are a limited number of graduate teaching assistantships, traineeships and research assistantships available.

Additional Information

Copies of a Department booklet with additional information concerning admission requirements, courses, faculty, facilities, etc. are available from:

Chair
Department of Human Nutrition and Food Systems
3304 Marie Mount Hall
University of Maryland
College Park, MD 20742
(301) 405-4928

For courses, see code FOOD, FSAD, NUTR.

Industrial, Technological and Occupational Education (EDIT)

Professor and Chair: Erekson

Professors: Hornbake (Emeritus), Maley (Emeritus) Luetkemeyer

Associate Professors: Beatty, Herschbach, Hultgren, Mietus, Peters, Stough, Sullivan

Assistant Professor: Boyce, Elkins,

The graduate programs in Industrial Technological and Occupational Education are designed to prepare specialized personnel in a variety of fields related to positions in education as well as government, business, industry and labor. Programs related to education prepare personnel for teaching, administration, research and supervisory positions in secondary, post-secondary and higher education as well as education assignments in government and military agencies. Programs designed for business and industry are in such fields as training, human resource development, production, supervision safety and fire science.

Specific teaching and education majors include Business Education, Home Economics Education, Industrial Arts/Technology Education, Marketing Education and Vocational-Industrial Education. The Industrial Technology program is directed toward the preparation of personnel for the business, industry and labor segments of society. These programs enjoy a national and international reputation.

Admission and Degree Information

Admission to the master's program requires a 3.0 undergraduate grade point average and the submission of the Miller Analogies Test or the Graduate Record Examination test scores. Admission to an A.G.S. or doctoral program requires a 3.5 grade point average in previous graduate studies, a 3.0 undergraduate grade point average and at least a 40 percentile on the Miller Analogies Test or Graduate Record Examination.

Programs are offered at the master's degree level in seven different areas: Business Education, Home Economics Education, Industrial Arts/Technology Education, Industrial Technology, Marketing Education, Technical Education and Vocational-Industrial Education. The Master of Arts and Master of Education degrees are offered in each of these program areas.

The Doctor of Education and Doctor of Philosophy degrees, as well as an Advanced Graduate Specialist certificate may be earned in the following areas: Business Education, Home Economics Education, Industrial Arts/Technology Education, Marketing Education and Vocational-Industrial Education.

Every graduate program is developed to meet the individual needs of each student. At the same time, each student is expected to have achieved certain specified objectives upon completion of his/her program. The student should exhibit competence in a major field; analyze, conduct and report research; and attain a broad understanding of the relationships of his/her field of study to education and society.

Facilities and Special Resources

The Department is housed in a large three-story structure fully accessible to the handicapped. The building includes an auditorium, research center, learning center, curriculum research center, seventeen laboratories, faculty and staff offices, seminar and classrooms.

In addition to the extensive library and computer facilities available on the College Park campus, numerous institutions located in the Washington-Baltimore area enrich the scholarly and research potential for the student. These institutions include the Library of Congress, Smithsonian Institution, U.S. Department of Education, International Technology Education Association, American Home Economics Association, American Vocational Association and the National Business Education Association.

Financial Assistance

A number of graduate assistantships are available to qualified graduate students.

Additional Information

For information and a Departmental brochure, please contact:

Chair
Department of Industrial, Technological and Occupational Education
University of Maryland
College Park, MD 20742
(301) 405-4539

For courses, see code EDIT.

Journalism Program (JOUR)

Professor and Dean: Cleghorn

Professor and Associate Dean: Levy

Professors: Beasley, Blumler, J. Grunig, Gurevitch, Hiebert, Holman

Associate Professors: Barkin, Zanot, Stepp

Assistant Professor: L. Grunig, McAdams, Paterson, Roche, Smith, Zerbinos

Professors Emeriti: Crowell, Martin

The College of Journalism offers a Master of Arts degree in Journalism and a Doctor of Philosophy degree, which is administered through the interdisciplinary program of Public Communication (see additional information under that program). The master's degree is designed for students who wish to deepen their understanding of communication professions and their preparation for those professions. It thus includes advanced practical courses and courses in communication theory and research. M.A. students can specialize in public affairs reporting, public relations, international communication, science communication, broadcast journalism, advertising, opinion and evaluative research or political communication.

The Ph.D. in Public Communication is an interdisciplinary program embracing the College of Journalism and three other departments: Radio-Television-Film, Speech Communication and Theatre. The Ph.D. prepares students for creative scholarship and research. It emphasizes both the necessary techniques and skills to conduct research and the ability to think innovatively about problems of public communication. Within this Ph.D. program, the College of Journalism stresses five fields: political and governmental communication, public relations and organizational communication, international communication, mass communication history, and science and medical communication. Other areas of emphasis in the Public Communication program include rhetoric and public address, broadcast communication, theatrical theory and aesthetics, theatre history and cinema history and aesthetics. For complete information on admission and degree requirements, see the "Public Communication Program" entry.

Admission and Degree Information

The master's degree is a 30-credit program with the typical student taking 12 hours of graduate work in the fall, 12 hours in the spring, and six hours of thesis or nonthesis option seminars in the summer or during an additional semester. Work on the degree may be started at any time. JOUR 600 and JOUR 601 are required for the M.A. in Journalism.

Applicants seeking admission to the master's program should hold a bachelor's degree from a recognized institution of higher learning. Undergraduate study of journalism and professional experience in journalistic fields are helpful but not required. Students who have majored in some other field as undergraduates are required to make up professional deficiencies by taking up to five selected courses in journalism without graduate credit. Completion of the general aptitude portion of the Graduate Record Examination is required, and three letters of recommendation must be submitted.

Facilities and Special Resources

The University of Maryland is in an advantageous location for the study of journalism. It is within easy reach of five of the nation's top newspapers: ***The Sun*** and ***Evening Sun***

of Baltimore, ***The Washington Post, The Washington Times*** and ***USA Today.*** It is also near the Washington press corps, the large Washington bureaus of the Associated Press and United Press International, ***The New York Times*** and many important American and foreign newspapers; NBC, CBS, ABC and other broadcasting news bureaus; and news magazines, major book publishing offices, public relations departments in corporations, government agencies, associations, scientific organizations, and public relations and advertising agencies. In addition, it is at the doorstep of the nation's major news makers in the executive, legislative and judicial branches of the federal government. The College has recently opened a student- staffed news bureau in Annapolis, from which graduate students cover the legislature and state government for Maryland newspapers and radio stations. A similar, student-run news bureau is planned for Washington, DC. The College also publishes the ***Washington Journalism Review,*** a highly respected, national media magazine with a circulation of 30,000.

Special facilities include photographic, electronic, broadcasting, news editing and advertising laboratories as well as a reading room with daily and weekly newspapers, magazines, clippings and bulletin files. The College's Center for Research in Public Communication engages in and supports a variety of research projects on topics of interest to the faculty and the Center's research associates. ***Knight Center for Specialized Journalism: Director:*** Howard Bray. The Knight Center was established in 1987 in the College of Journalism with a three- year grant from the Knight Foundation. The Center awards fellowships to experienced reporters and editors for intensive, specially-designed courses to enhance their understanding of complex subjects such as finance and economics, science, medicine and health, and the law. By mid-1989 the Center awarded 104 fellowships to newspaper, magazine and broadcast journalists for four non-credit courses. A National Advisory Board of senior news executives and journalists provides guidance to the Center.

Financial Assistance

The College of Journalism offers a limited number of assistantships in exchange for teaching or research assistance in journalism of up to 20 hours per week. Internships in various offices both on and off campus also are available to journalism graduate students as are some fellowships and scholarships.

For courses, see code JOUR.

Kinesiology Program (KNES)

Professor and Chair: Clarke

Professors: Dotson, Kelley, Sloan, Steel, Vaccaro

Associate Professors: Clark, Hagberg, Hatfield, Hult, Hurley, Phillips, Santa Maria, Struna, Wrenn

Assistant Professors: Arrighi, Caldwell, Chalip, Ennis, Ryder, Scott, Tyler, VanderVelden

The graduate student majoring in kinesiology may pursue the degree of Master of Arts (thesis and non-thesis options) or Doctor of Philosophy. The two major objectives of these programs are: (1) to study the discipline of kinesiology by examining the effects of physical activity on individuals from physiological, kinesiological, psychological, social and historical points of view; and (2) to acquaint the student with curricular aspects of physical education, to improve the quality of teaching and to offer the student

ways of improving the administration and supervision of programs in schools and colleges.

The graduate program is organized into three divisions offering major emphasis as follows: (1) Division of Sport Studies including social history of sport, sport psychology, philosophy of sport and sociology of sport; (2) Division of Biophysical Studies with specialties in exercise physiology, motor learning (M.A. only), motor development and biomechanics; and (3) Division of Professional Studies with emphasis on curriculum/instruction, and sport management (M.A. only).

Admission and Degree Information

The minimum requirement for admission to the M.A. program in kinesiology is a B or 3.0 average for the last two years of undergraduate study both in the major and related subject fields. Students who do not quite meet this requirement may be admitted provisionally. Undergraduate prerequisites for advanced study in kinesiology include physiology of exercise, kinesiology, statistics and two courses from a discretionary pool. Students without these courses may register as special students or be admitted provisionally with limited course deficiencies. The Graduate Record Examination (GRE) is required for admission (GMAT or GRE for Sport Management).

Admission to the Ph.D. program is based on the satisfactory preparation for advanced graduate work and demonstrated potential for scholarly achievement. A grade point average of B+ (3.5 on a 4.0 point scale) in previous graduate work, with at least a 3.0 overall average in the final two years of undergraduate study is the scholastic standard for admission. The GRE is also required for admission. A student may be admitted on a provisional basis in those cases where special qualifications are apparent from letters of recommendation and documentation of special backgrounds but where the scholastic standards stated above are not met in their entirety.

Completion of the master's degree (thesis option) requires a minimum of 24 semester hours, exclusive of the required six hours of thesis credit. Six credits are required in the KNES specialty area (Sport Psychology, Exercise Physiology, etc.) with six additional KNES hours required. Six credits of research processes courses are also required. Twelve elective credits may also be taken within or outside the major department. Full-time students usually complete the master's degree in two years.

Students who choose the non-thesis option must also complete a minimum of 30 semester hours. Six credits of research processes courses that supports the major subject matter area are required as well as a minimum of six credit hours in the KNES major specialty. Fifteen elective credits may be taken within or outside the major department. Students must also complete an independent investigation project under the direction of a graduate faculty member. In addition, students must pass a final comprehensive examination.

The doctoral degree requirements consist of coursework in the following areas: (1) a minimum of 12 credits in the area of specialization; (2) a minimum of six credits in an additional area within the graduate program to serve as a support area; and (3) a minimum of 15 credits in a related studies area selected from outside the Department. In some instances more credits may be required for completion of this requirement, which must support the dissertation's subject. Students may take from 12 to 18 dissertation credits.

Students must demonstrate competency in research, including the basic understanding of scientific method. Normally, this competency includes a demonstration and understanding of research processes, quantitative methods of analysis and the principles underlying statistical aspects of experimental and non-experimental designs in kinesiology.

No foreign language is formally required for the Ph.D. degree, but it may be required by advisers whose students are doing extensive reading in German, Spanish, French, Russian or some other language.

Facilities and Special Resources

The Department maintains a modern research laboratory including, but not limited to: psychophysiological influences in exercise and sport; graphical analysis and modeling of human movement; learning and developmental influences on performance of motor tasks; assessment of body composition, blood constituent variations, cardiovascular and pulmonary functions and environmental factors. In addition, small animal paradigms and quantitative and naturalistic examination of the teaching-learning process are also supported. The College of Health and Human Performance also supports a microcomputer laboratory that includes two local networks (IBM and Apple), each of which is connected to the campus' mainframe network. Numerous IBM and Apple workstations are housed within the laboratory.

Financial Assistance

A number of graduate assistantships are offered each year. Specific responsibilities include teaching or assisting in the research laboratory.

Additional Information

For further information and application, contact:

David L. Kelley
Director of Graduate Studies
Department of Kinesiology
University of Maryland
College Park, MD 20742
(301) 405-2455

For courses, see code KNES.

Library and Information Services Program (LBSC)

Professors: Burke, Kidd, Liesener, MacLeod, Soergel, Walston, Wasserman

Associate Professors: Marchionini, White

Assistant Professors: Aversa, Choi, Green, Jeng, Neuman, Williams (Joint Appointment with Curriculum and Instruction)

Lecturer: Cunningham, Wilson (librarian/lecturer)

The College offers programs leading to the Master of Library Science (M.L.S.) and the Ph.D. in Library Science; a joint degree of an Master of Arts in History and the M.L.S. for students who desire advanced studies in the field of archives, manuscripts and historical collections (for details see the entry in this catalog following History); and a joint degree of an M.A. in Geography and the M.L.S. (for details see the entry in this catalog under Geography). The College, which is fully accredited by the Amer-

ican Library Association, also provides courses, seminars and workshops for non-degree students who are seeking continuing education and professional development opportunities.

The degree programs emphasize the theoretical and conceptual foundations of the field. The application of the results of scholarly research are related to current practices and are analyzed with the goal of advancing the quality and scope of services in a variety of information settings.

Specialized study opportunities are offered in such information organizations as public, academic, special and school libraries, and/or in subfields such as automated applications, reference services (conventional and online), archival and records management, the organization of knowledge, and information storage and retrieval. Students who complete the school media specialization usually obtain Maryland state certification as Educational Media Generalists, Level II.

The academic program can be augmented by a Field Study in Library Service option in which the student may obtain professional, supervised experience. More than 160 field study sites have been approved including such federal agencies as the Library of Congress, the National Library of Medicine, the National Gallery of Art, corporations and professional associations.

Admission and Degree Information

Applicants must exhibit the capacity and motivation for graduate study and the potential to contribute to the library and information services profession. Accordingly, in addition to the Graduate School requirements, the Graduate Record Examination and letters of recommendation are required. The applicant's undergraduate record, major discipline, work experience and statement of purpose are also required to form the basis for the admission decision. The College's Committee on Admissions and Academic Standards may also request a personal interview and will consider requests for exceptions in unusual cases.

Master's candidates plan their programs individually based on recommendations from faculty advisers on courses they consider most appropriate for each student. Upon entry into the program, all students are required to register for the Proseminar and introductory courses in the organization of knowledge, reference and computer applications. These four core courses introduce the student to the broad range of disciplines fundamental to library and information services. Assisted by the faculty adviser, the student then chooses the remaining 24 credit hours to fulfill his/her academic and professional goals. The student may, with the consent of the adviser, take courses in other campus departments and the consortium, and they may also pursue an area of particular interest as an independent study under the supervision of a faculty member.

The Master of Library Science degree is awarded to the student who successfully completes a program of 36 hours with a 3.0 grade point average within three years from first registration in the program. The program accepts both part-time and full-time students, who can complete the necessary coursework within 12 months. While it is possible to begin the program in any semester, the faculty recommends that students who wish to complete the program within a calendar year start in the summer session with two required courses, take four courses in the fall and spring semesters and finish the program by taking two courses in the next summer session. All M.L.S. courses

except some very specialized ones with small enrollments are offered at night on a regular rotation.

No thesis or comprehensive examination is required for the M.L.S.

The doctoral program is interdisciplinary in nature and utilizes the resources not only of the College but of the entire campus. The student and adviser first design a program of study and research that support the student's professional objectives. Approximately three years of full-time study are then required, normally divided into two years of formal coursework (60 semester hours, or 36 beyond the master's) and one year of work on the dissertation. At least one year, usually the first, must be spent in full-time residence.

A doctoral qualifying examination is required at the conclusion of the first year to determine the student's ability to complete the program. After completion of the required course credits and prior to admission to candidacy, the student must pass written comprehensive examinations in five areas. An oral defense of the dissertation is scheduled prior to the awarding of the degree.

The College has no language requirements unless the individual student's specialization or dissertation requires it.

Facilities and Special Resources

The College maintains its own library, which is organized to give faculty, students and research staff the kind of modern support service provided by other forward-looking agencies. Students have access to the University of Maryland's excellent Computer Science facility and the College's Information Processing Laboratory, which serves as a resource for faculty and student research, as well as instruction in library automation and information processing. Thus, students have access not only to the University's large-scale computer systems, but to microcomputers housed within the College. The Instructional Development and Support Center, a non-print media facility, also provides equipment and materials, workshops and individual assistance to students, faculty and staff in all areas of audiovisual production.

Financial Assistance

The College and University offer a limited number of scholarships, fellowships and teaching and research assistantships. Other sources of aid include work-study (through the University and outside agencies), federally insured loans and grants from local and national agencies and organizations.

The M.L.S. degree program has been accepted by the Southern Regional Educational Board Academic Market, so residents of Virginia and West Virginia are eligible for in-state tuition fees. In-state tuition fees for the CLIS Ph.D. program are also available for students from the states of Alabama, Mississippi, South Carolina, Virginia and West Virginia.

Information on the availability of financial aid may be requested from the Director of Admissions, College of Library and Information Services.

Additional Information

For specific information on Departmental programs, admission procedures or financial aid, contact:

Director of Admissions

Room 4110, Hornbake Library
University of Maryland
College Park, MD 20742
(301) 405-2038
For courses, see code LBSC.

M.A. in Geography and the M.L.S. Course of Study

(See entry after Geography Program)

M.A. in History and the M.L.S. Course of Study

(See entry after History Program)

Linguistics Department (LING)

Professor and Chair: Lightfoot

Professor:

Associate Professor: Hornstein

Assistant Professor: Gorrell, Inkelas, Lebeaux, Uriagereka, Weinberg

The Linguistics Department offers graduate study leading to the Master of Arts and Doctor of Philosophy degrees. Students are exposed to a research enterprise that seeks to discover what a person's linguistic capacity consists of: how it arises in children; how it functions in speaking, listening, etc.; how it relates to other cognitive capacities; and how it can be investigated by various methods including those of experimental psychology and computer sciences.

The program has some distinctive emphases:

1. Students must develop a minor area of specialization.
2. The psychological embedding of linguistic theories and on cross-language work are emphasized.
3. Special provisions are made for students who start graduate work with a thorough background in linguistics and clear ideas about their research plans.
4. The Department desires students who are native speakers of a language that has not been extensively analyzed and who wish to work on a grammar of that language.
5. The Department houses a new phonetics library and the Linguistics Research Laboratory for work in experimental psycholinguistics and computational linguistics.

Admission and Degree Information

Students with a strong undergraduate background in areas such as linguistics, mathematics, psychology, computer science, philosophy, anthropology, English and foreign languages are invited to apply. Students must have a background equivalent to what is covered in the core of the bachelor's degree in Linguistics (essentially two semesters of generative syntax and two semesters of phonology). Students who lack this background may be admitted with "Provisional Graduate Status" and take undergraduate courses in syntax and phonology along with graduate-level courses for which they meet the prerequisites.

M.A. students take a total of 36 credits: 21 credits in LING and nine credits in an area such as biology, computer science, language pathology, philosophy, psychology or a particular language for the minor area of specialization. In addition, either a thesis or two comprehensive papers in distinct areas of language study will be written.

Ph.D. students normally satisfy the requirements for the M.A. although the thesis/two comprehensive papers may be waived for students who have clear research plans and who apply successfully to proceed directly to the Ph.D. Students must complete 12 LING credits at the 800-level and six 600-level credits in non-LING courses. After completing course requirements, students write a research paper that demonstrates a capacity for productive research, makes an original contribution to the field and normally forms the basis for the dissertation research. After satisfactory completion of the research paper, students write a dissertation.

Financial Assistance

The Linguistics Department administers a number of teaching and research assistantships. Students may also express an interest in teaching assistantships in other departments; our students often compete successfully for such teaching assistantships.

Additional Information

Application materials and a brochure outlining further details of the program can be obtained from:

Chair
Department of Linguistics
University of Maryland
College Park, MD 20742
(301) 405-7002

For courses, see code LING.

Marine-Estuarine-Environmental Sciences Program (MEES)

Interim Program Committee Director: Strand (AREC)

Assistant Director: Rebach (UMES)

Assistant Director: Bonar (ZOOL); Cronin (UMBC); Genys (Appalachian Environmental Lab); Gupta (UMES); Helz (CHEM); Brooks (UMES); Kennedy (Horn Point Environmental Lab); Naumann (UMAB); Roesijadi (Chesapeake Biological Lab)

The university-wide graduate program in Marine-Estuarine-Environmental Sciences (MEES) offers Master of Science (with thesis) and Doctor of Philosophy degrees and is designed to meet the needs of students who wish to pursue studies on the interactions among biological, physico-chemical and human systems. Areas of emphasis will involve organisms living in marine, estuarine or terrestrial environments and their interactions with chemical and physical influences. Possible areas of specialization might include estuarine and marine science, environmental chemistry, environmental microbiology, environmental toxicology, environmental and resource economics, environmental management, marine and environmental technology, and fisheries and wildlife management.

Graduates find employment in various federal and state environmental agencies. In addition, academic and private research institutions and commercial interests concerned

with the development and use of coastal, estuarine and ocean resources find graduates well prepared for a variety of positions.

Admission and Degree Information

In addition to the Graduate School admission requirements, applicants must submit scores from the GRE Aptitude Test. The applicant's written statement of personal goals is most important in the admissions process. Degree work may be pursued on a part-time basis.

The program is interdisciplinary, and the course of study will be tailored to the individual student's needs as determined by that student's advisory committee. There are several specific prerequisites, but these may be satisfied through coursework after the student is admitted to the program. All degree candidates must take statistics and complete an approved graduate level course in each of the four distribution areas: biology, chemistry, physical sciences and management. Course credit requirements and research are not in excess of general Graduate School requirements for the M.S. and Ph.D.

Facilities and Special Resources

Facilities and faculty throughout the statewide university system are available for the program. The degree candidate may take courses on any campus and may have an advisory committee composed of participating MEES faculty from several locations, including laboratories of the University's Center for Environmental and Estuarine Studies (CEES) and the Center of Marine Biotechnology (COMB). Research programs may also be conducted at off-campus sites, including the laboratories of CEES (Chesapeake Biological Laboratory and Horn Point and Appalachian Environmental Laboratories) and COMB.

Campus facilities include well-equipped laboratories for research in most areas of environmental sciences. Maryland has an active Sea Grant research program, and students in marine and estuarine work will have access to laboratory-equipped research vessels for work on the Chesapeake Bay and on other waters.

In addition, students will find their work greatly enhanced by the ties most faculty members maintain with many government laboratories and agencies in the Washington-Baltimore areas. Library resources are among the best in the nation due to the proximity of the National Agricultural Library and the Library of Congress, along with several other specialized libraries unique to the area.

Financial Assistance

Financial assistance in the form of teaching and research assistantships (through participating departments and the CEES laboratories) as well as some fellowships may be available to exceptionally qualified candidates.

Additional Information

For additional information, contact:

Dr. Ivar E. Strand, Interim Director
MEES Program
3220 Symons Hall
University of Maryland
College Park, MD 20742

(301) 405-5343
For courses, see code MEES.

Mathematical Statistics Program (STAT)

Director: Slud

Professors: Freidlin, Kagan, Mikulski, Slud, Syski, Wei, Yang

Associate Professors: Kedem, Smith

Assistant Professors: Fakhre-Zakeri, Lee

The Mathematical Statistics Program offers the Master of Arts and Doctor of Philosophy degrees for graduate study and research in statistics and probability. Areas of faculty research activity include statistical decision and estimation theory, biostatistics, stochastic modeling, robust and nonparametric inference, analysis of variance, theory and inference for stochastic processes, stochastic analysis and time series. Students may specialize in applied or theoretical statistics by selecting an appropriate sequence of courses and a research area to form an individual plan of study. The Program has been designed with sufficient flexibility to accommodate the student's background and interests. The Program also offers students from other disciplines an opportunity to select a variety of statistics courses to supplement their own study.

The Program is administratively affiliated with the Department of Mathematics, which maintains the records of all students in the Mathematical Statistics Program and handles correspondence with those applying for admission. However, any application for admission must indicate clearly that the student wishes to enter the Statistics (STAT) Program.

Employment prospects for statisticians continue to be extremely bright. All recent M.A. and Ph.D. graduates of Maryland's STAT Program have found jobs in universities, government or private industry.

Admission and Degree Information

In addition to the Graduate School requirements, applicants with at least a B average (3.0 on a 4.0 scale) should have completed an undergraduate program of study that includes a strong emphasis on rigorous mathematics or statistics. Mathematical preparation at least through the level of advanced calculus will normally be considered sufficient demonstration of the expected mathematical background. In special cases students may be provisionally admitted without having fulfilled the general admission requirements if other criteria present evidence of potential success in the Program. The Graduate Record Examination is not required for admission, but applicants who have taken this examination are required to supply their score.

The M.A. degree program offers both a thesis and non-thesis option. For the non-thesis option, a student must complete 30 credit hours with at least a B average; at least 18 of these credits must be at the graduate level (600/700 level) and at least 12 of the graduate credits must be in statistics. The student must also pass the Mathematics Department written examination in probability, mathematical statistics and applied statistics or any field of mathematics. The student may take either the separate M.A. written examination or the Ph.D. written examination, which requires a lower score to pass. These examinations can be taken only twice, but any attempt during the first

two years of graduate work is considered a "free try." The student must also submit a satisfactory short scholarly paper.

For the thesis option, a student must: (1) complete 24 credit hours with at least 15 at the 600/700 level (of these 15 hours, at least 12 hours must be in statistics); (2) maintain an average grade of B or better; (3) take six hours of STAT 799 (Research) in addition to (1); (4) write a satisfactory thesis; and (5) pass a final oral examination.

There is no foreign language requirement for M.A. students.

The M.A. degree is not required for admission to the Ph.D. program. A doctoral student must complete a minimum of 36 hours of formal courses (at least 27 at the 600/700 level) with an average of B or better; at least 18 of the graduate credits must be taken in statistics. In addition, the University requires at least 12 hours of STAT 899 (Doctoral Research).

The Ph.D. student must take a written examination in probability, statistics and any third field of mathematics. Like the M.A. degree, the written examination can be taken only twice, but any attempt during the first two years of graduate work is considered a "free try." The written examination is given by the Mathematics Department twice a year in January and August.

If successful in this written examination, the student must pass an oral examination. Administered by the statistics faculty, the oral examination usually takes place a year after the student passes the written examination. This examination serves as a test of the student's in-depth preparation in the area of specialization and his or her research potential. Successful completion of the oral exam indicates that the student is ready to begin writing the doctoral dissertation. In addition, the Department requires a reading competence in two foreign languages for the Ph.D. The student may select any two of three languages: French, German or Russian. Administered and graded by the Mathematics Department, the language examination consists of translating foreign mathematical texts into competent English.

To be admitted to candidacy, the Ph.D. student must pass the written examination, the oral examination and at least one of the two language examinations. The second language examination must be completed before the candidate's final oral examination on the dissertation.

Additional Information

For more information, contact:

Director
Mathematical Statistics Program
1105 Mathematics Building
University of Maryland
College Park, MD 20782
(301) 405-5061

For courses, see code STAT.

Mathematics Program (MATH)

Professor and Chair: Markley

Professors: W. Adams, Alexander, Antman, Arnold, Auslander, Babuska[1], Benedetto, Berenstein, Brin, Chu, Cohen, Cook, Cooper, Correl, Edmundson[2],

Ehrlich, Evans, Fey[3], Fitzpatrick, Freidlin, Goldberg, Goldhaber, Gray, Greenberg, Grove, Gulick, Herb, Horvath, Hubbard1, Hummel, Johnson, Kagan, Kellogg[1], King, Kirwan, Kleppner, Kudla, Kueker, Lay, Lehner, Lipsman, Liu, Lopez-Escobar, Markley, Mikulski, Millson, Neri, Olver[1], Osborn, Owings, Rosenberg, Rudolph, Schafer, Slud, Sweet, Syski, Vogelius, Washington, Wei, Wolfe, Wolpert, Yakobson, Yang, Yorke, Zagier, Zedek

Adjunct Professor: Shanks

Associate Professors: Berg, Boyle, Dancis, Ellis, Glaz, Goldman, Green, Hamilton, Helzer, Jones, Kedem, Maddocks, Sather, Schneider, Smith, Warner, Winkelnkemper

Assistant Professors: J. Adams, Chang, Currier, Fakhre-Zakeri, Grillakis, Laskowski, Lee, Li, Nochetto[1], Stuck, Wang, Wu

[1]Joint appointment with the Institute for Physical Science and Technology
[2]Joint appointment with Computer Science
[3]Joint appointment with Secondary Education

Three programs fall under the cognizance of the Mathematics Department: the Mathematics Program proper (MATH), the Mathematical Statistics Program (STAT), and the Interdisciplinary Applied Mathematics Program (MAPL). Students applying for admission should use the appropriate symbol to indicate their program of interest. The Statistics Program is concerned with mathematical statistics and probability. The Interdisciplinary Applied Mathematics Program is described in detail elsewhere in this catalog, but, as its name implies, is concerned with the interaction between mathematics and applied areas. It is directed by the Graduate Applied Mathematics Committee but administered by the Mathematics Department.

Students can earn Master of Arts and Doctor of Philosophy degrees in each of these three programs. The master's degree is not required for entrance to the Ph.D. program.

The Department offers graduate programs in algebra, complex analysis, geometry, mathematical logic, number theory, numerical analysis, ordinary differential equations, partial differential equations, probability, real and functional analysis, statistics and topology.

Graduates in both Ph.D. and M.A. programs continue to face a favorable employment market. Academic opportunities are becoming more encouraging; our Ph.D.s have in some cases secured prestigious academic posts (MIT, Yale, NYU). Those in the applied programs face a very encouraging employment environment and have secured good positions in government and industry.

Admission and Degree Information

Admission is granted to applicants who show promise in mathematics as demonstrated by their undergraduate record. Unless courses in advanced calculus and (undergraduate) abstract algebra have been taken, admission may be on a provisional basis (passing MATH 410 and/or 403 with a grade of B). The Graduate Record Examination is not required for admission, but applicants who have taken this examination are required to supply their score.

The M.A. degree program offers both a thesis and non-thesis option; most students choose the latter. The non-thesis option requires students to take 30 credit hours with an average of at least a B. At least 18 credits must be at the 600/700 level, including

at least 12 hours in mathematics. Students must also complete two full-year sequences at the 600/700 level and must pass the Departmental written examinations in three mathematical fields. In addition, the University now requires a scholarly paper.

Students may take the separate M.A. battery of written examinations or take the Ph.D. version and be scored at a lower level. These examinations can be taken only twice, but any attempt during the first two years of graduate work is considered a "free try." The M.A. degree includes no foreign language requirement. It generally takes from two to three years to earn the M.A. and almost 25-30 degrees are granted each year in mathematics (MATH, STAT, and MAPL combined).

The Ph.D. program does not require an M.A. degree, but applicants who are accepted should show, on the basis of their undergraduate record and recommendations, that they possess not only marked promise in mathematical activities but the potential to perform on a creative level. Like the M.A. program, admission may be granted on a provisional basis.

Students in the Ph.D. program must complete a minimum of 36 hours of formal coursework (at least 27 at the 600/700 level) with an average grade of B or better; at least 18 hours must be taken in the Department of Mathematics. In addition, the University requires at least 12 hours of MATH 899 (Doctoral Research).

Ph.D. students must take a set of three written examinations in three mathematical fields. These examinations can be taken only twice, but an attempt during the first two years of graduate study constitutes a "free try." These examinations are given twice a year in January and August. If successful in these written examinations, students must satisfy the particular requirements of the field committee governing their special area of interest before they can be admitted to candidacy and engage in thesis research. The dissertation must represent an original contribution to mathematical knowledge and will usually be published in a mathematical journal.

The average Ph.D. student will spend five years of graduate study before obtaining the degree. The Department awards from five to 10 Ph.D.s each year.

The Ph.D. program has two foreign language requirements. Before the student can be admitted to candidacy, he or she must pass a written examination in either French, German or Russian and translate mathematical texts into competent English. The second language examination must be completed before the candidate's final oral examination on the dissertation. Both language examinations are composed and graded within the Department.

Facilities and Special Resources

The Department is very active in research in a number of areas, strengthened further by a complement of mathematicians from the Institute for Physical Science and Technology. The Department fosters a lively program of seminars and colloquia; about half of these talks are given by outside specialists.

The Engineering and Physical Sciences Library is located on the ground floor of the Mathematics Building and contains more than 95,000 volumes in mathematics, physics and engineering, and more than 280 journals in pure and applied mathematics. The Library of Congress, with its extensive collection of books and technical reports, is only a half hour from the campus.

The Department cooperates closely with the Institute for Physical Science and Technology and with the Department of Computer Science. Faculty members of both groups offer courses in the Department, and the facilities of the computer center are available to serve the research needs of both faculty and graduate students. Members of the Department participate actively in the Interdisciplinary Applied Mathematics Program and they also staff the Mathematical Statistics Program.

Financial Assistance

The Department is able to offer graduate assistantships to approximately 110 graduate students. The teaching load is six hours each semester plus the duties of meeting with students and grading papers. A number of fellowships and research assistantships are also available.

Additional Information

Special brochures and publications offered by the Department are: "Mathematics at Maryland, the Graduate Program," "Departmental Policies Concerning Graduate Students," and "Graduate Course Descriptions."

Ms. Janet Cooper, the Administrator of the Graduate Committee of the Department, can be contacted regarding Departmental programs, admission procedures, and financial aid. Call (301) 405-5058. For courses, see code MATH.

Measurement, Statistics, and Evaluation Program (EDMS)

Professor and Chair: Lissitz

Professors: Dayton, Macready, Stunkard

Associate Professors: Benson, Johnson, Schafer

Assistant Professor: DeAyala

The Department of Measurement, Statistics, and Evaluation offers graduate study leading to the Master of Arts and a Doctor of Philosophy degrees for students who desire an advanced degree in measurement, statistics or program evaluation. A doctoral minor is also offered for students majoring in other areas.

Graduates have been very successful in finding employment because they are equipped to make contributions in a wide variety of fields. Thus, if the employment potential of one area tightens, the student has the requisite skills to move into another area where jobs are more available.

Admission and Degree Information

Students who seek admission to the master's program must have at least a 3.0 undergraduate grade point average and submit the Graduate Record Examination test score. Admission to a doctoral program requires a 3.5 GPA in previous graduate studies and either a 3.0 undergraduate GPA or at least a 40 percentile on the GRE. The GRE aptitude test scores and other application information are used to reach a decision on each applicant.

The doctoral major program is primarily intended to prepare individuals to teach at the college level in program evaluation, measurement and statistics; conduct research studies; advise in the conduct of research studies; and serve as applied statistics, measurement and evaluation specialists in school systems, industry and government.

The master's level program is designed to produce qualified individuals to work in schools, industry and government. Both the thesis and the non-thesis option are offered and a program for each student is planned to take into account his/her own background and future aims. About half the work within the major is selected to meet the needs and interests of the individual student.

Facilities and Special Resources

For students who plan to teach at the college level, the Department offers supervised activities that are appropriate for future faculty whose specialization will be in these areas. Students who plan to conduct research can gain experience using the Department's mainframe and microcomputer equipment.

The faculty are actively engaged in a large variety of research projects. Students are encouraged to become involved to gain experience from these activities. The Washington and Baltimore areas have a large number of organizations that provide ready opportunity to become involved in projects that have national importance.

Financial Assistance

Some graduate assistantships and other funds are available. Once students have the equivalent of the first year of coursework, they can easily secure good part- time employment to support the continuation of the degree. In many cases, part- time jobs can lead to full-time career employment after the student finishes the degree objective. In other cases, students wait until they obtain their degree before seeking employment outside the University.

Additional Information

For information and a Departmental brochure, please write to:

Dr. Robert W. Lissitz, Chairperson
Measurement, Statistics, and Evaluation
College of Education
University of Maryland
College Park, MD 20742
(301) 405-3624

For courses, see code EDMS.

Mechanical Engineering Program (ENME)

Professor and Chairman: Fourney

Professors: Allen, Anand, Armstrong, Berger, Buckley, Cunniff, Dally, Dieter, Durelli, Gupta, Holloway, Irwin, Kirk, Koh, Magrab, Marcinkowski, Marks, Sallet, Sanford, Sayre, Shreeve, Talaat, Wallace, Weske (Emeritus), Yang

Associate Professors: Barker, Bernard, Dick, diMarzo, Duncan, Harhalakis, Krayterman, McCaffrey, Pecht, Poarbabai, Radermacher, Shih, Tsai, von Kerczek, Walston, Yanushevsky

Assistant Professors: Abdelhamid, Anjanappa, Azarm, Bigio, Dasgupta, Gore, Haslach, Herold, Humphrey, Khan, Marasli, Minis, Ohadi, Piomelli, Rao, Sirkis, Ssemakula, Tasch, Tsui, Wilner, Zhang

Lecturers: Case, Coder, Cook, Ethridge, Russell, Werneth

The Mechanical Engineering Department offers a broad-based program leading to the Master of Science and Doctor of Philosophy degrees with courses drawn from four

different areas of specialization: energy, fluid mechanics, solid mechanics and computer integrated manufacturing and design. In certain cases students may wish to concentrate their studies early in their graduate work, and M.S. programs in each of the four areas of specialty are available. For the Ph.D. program, which stresses research capabilities, an area of specialization should be selected early so that the student can establish the depth of understanding in a given technical area necessary to begin thesis research.

Program Specialties

1. Energy. This area of specialization treats the transformation, transportation, storage and utilization of all types of energy. The area encompasses: combustion, energy conversion, heat and mass transfer, and thermodynamics. Combustion deals with the efficient combustion of petroleum, alternative and future low grade fuels without adverse effects of the emission of undesirable trace pollutants. Energy conversion covers gas turbines, internal combustion engines, furnaces, combustors, heat pumps, thermoelectrics, thermionics, photovoltaics, fuel cells and magnetohydrodynamics. Analytical, empirical and experimental solutions are developed in solving heat and mass transfer problems. The coverage in thermodynamics includes macroscopic and microscopic considerations, statistical methods and irreversible processes.
2. Fluid Mechanics. Students are prepared for study in advanced analytical and experimental methods in fluid mechanics. Areas of study include ground vehicle aerodynamics, hydrodynamics, two-phase flow, boundary layers and jets, vortex dynamics, fluid-structure interaction, turbulence, turbulence closure modeling and combustor flows. Laboratory facilities are available for research in turbulence, vehicle aerodynamics, two-phase flow, vortex motions and hydromechanics.
3. Solid Mechanics. This area of specialization emphasizes exposure to fundamental concepts in analytical and experimental methods of solid mechanics. Areas of study include theoretical and applied elasticity, fracture mechanics, experimental mechanics, noise and vibration control, acoustics, numerical modeling, and linear and nonlinear mechanics. Laboratory facilities are available for research in stress analysis, fracture, vibrations, photoelasticity and holography.
4. Computer Integrated Manufacturing and Design. The disciplines of controls, mechanical design, manufacturing processes and robotics are combined with a strong emphasis on computer application throughout the areas. A wide variety of courses and research topics are available and are supported by dedicated laboratories in microprocessors and interfaces, manufacturing processes, robotics and computer-aided design/computer-aided manufacturing. Typical research topics include the use of microprocessors for smart product design; the integration of a flexible manufacturing cell into the factory of the future; circuit board design; integration of CAD, CAM and manufacturing resource planning; and systems analysis, control and automation.

Graduates with an M.S. or Ph.D. in mechanical engineering are in higher demand than ever by a wide variety of industries and the federal government. Career oppor-

tunities in academia are also excellent for Ph.D. graduates because of the shortage of qualified persons in mechanical engineering.

Admission and Degree Requirements

The programs leading to the M.S. and Ph.D. degrees are open to qualified students holding the B.S. degree in mechanical engineering. Admission may also be granted to students with degrees from closely allied areas such as other branches of engineering and physics. In some cases students may be required to take undergraduate courses to satisfy a complete background on the subject. In addition to the Graduate School requirements, the GRE General (Aptitude) Test is also required.

The M.S. degree program offers both a thesis and non-thesis option. The equivalent of at least three years of full-time study beyond the B.S. degree is required for the Ph.D. degree. Ph.D. students must take a qualifying examination upon entering the program. In addition to the Graduate School rules, the Department sets forth certain special degree requirements in its publications.

Facilities and Special Resources

The Department maintains laboratory facilities for graduate research. Air guns, impact testers, vibration shaker tables and acoustic analysis equipment are available for studies in dynamic stress analysis and vibration. Static and dynamic stress analysis are conducted by photoelastic and holographic techniques. Experimental fluid dynamics studies are carried out in wind tunnels, on a water table and in a two-phase flow loop. Research in engineering materials is supported by a large complement of departmental mechanical testing equipment and by an electron microscope facility, an x-ray diffraction facility and crystal growing equipment available from the Institute for Physical Science and Technology. Combustion research facilities include various types of combustors, heat exchangers, droplet generators, and a fouling and particulate deposition apparatus. Research in computer-integrated manufacturing and design is carried out in CAD/CAM, robotics, manufacturing processes and microprocessor laboratories. Departmental computational equipment consists of more than 100 modern microcomputers. This includes a selection of PC's, AT's and PS2's. The Departmental CAD laboratory is DEC-based and has two VAX-servers, seven DEC-based VAXSTATION II Workstations, 8 VAX-Stations III workstations, two TEKTRONIX 4115B's and a selection of dumb terminals that are used to access the various pieces of software located on the VAX cluster.

Financial Assistance

Financial assistance is available to outstanding students in the form of fellowships, teaching assistantships and research assistantships. Preference is given to U.S. applicants.

Additional Information

Additional information may be obtained from:

Graduate Adviser
Department of Mechanical Engineering
2168 Engineering Classroom Building
University of Maryland
College Park, MD 20742
(301) 405-4216

For courses, see code ENME.

Meteorology Program (METO)

Professor and Chair: Vernekar (Acting)

Professors: Baer, Shukla, Thompson

Senior Research Scientists: Rasmusson, Schneider

Associate Professors: Carton, Dickerson, Ellingson, Pinker, Robock

Associate Research Scientists: Sellers, Straus, van den Dool

Assistant Research Scientists: Kinter, Nigam

Research Associates: Cai, Canfield, Doddridge, Goswami, Gutman, Holland, Klein, Krishnamurthy, Laszlo, Luke, Oh, Raghunath, Rasmusson, Saha, Semazzi, Wang, Xue

The Meteorology Department offers graduate study leading to the Master of Science and Doctor of Philosophy degrees with specialization in the atmospheric sciences. Coursework in meteorology is also offered at the upper division and graduate level as a service to other campus graduate programs.

The educational program in the atmospheric sciences is broadly based and involves many applications of the mathematical, physical and applied sciences that characterize modern meteorology. Research specializations include atmospheric dynamics, atmospheric radiative transfer, global climate change, remote sensing of the atmosphere, climate dynamics, numerical weather prediction, atmospheric chemistry, synoptic meteorology, air pollution, micrometeorology, tropical ocean circulation, ocean-atmosphere interaction and biosphere-atmosphere interactions.

The Meteorology Department houses the Center for Ocean-Land-Atmosphere Interactions (COLA) under the direction of Professor Shukla. The Center conducts a coordinated research program on the predictability of the coupled atmosphere- ocean-biosphere global climate system, especially toward establishing a physical basis for dynamical extended range forecasting. The Department also operates the Cooperative Institute for Climate Studies in conjunction with NOAA. Under the direction of Professor Ellingson, the Institute conducts research in long-range forecasting and satellite remote sensing. In addition, the Department maintains close research and teaching associations with the Department of Chemistry and nearby government agencies including NOAA, NASA and NIST.

The Department's close association with federal agencies in the Washington area provides graduates with good career opportunities in the atmospheric sciences. As a research assistant, the student often has the opportunity to develop a close working relationship with one or more of the scientific agencies, which can put the student in a good position to contend for jobs as they become available.

Located in the Computer and Space Sciences Building, the Meteorology Department is part of the College of Computer, Mathematical and Physical Sciences.

Admission and Degree Information

The advanced degree programs in meteorology are open to students who hold a bachelor's degree in meteorology, physics, chemistry, mathematics, astronomy, engineering or other programs with suitable emphasis in the sciences. Comprehensive,

undergraduate level courses in meteorology are provided for students from disciplines other than meteorology.

Facilities and Special Resources

Special facilities that support the Department's teaching and research activities include equipment for receiving facsimile maps and digital alphanumeric data from the National Weather Service, an instrumented weather station (a NOAA cooperative observing station), a laboratory for atmospheric chemistry and a mobile air pollution laboratory.

Special data collections that support teaching and research activities include Northern Hemisphere meteorological data tabulations on microfilm, a unique historical daily weather map series dating back to 1899, a complete set of climatological data for the United States dating back to 1917, a Geosynchronous Operational Environmental Satellite data archive including visible and infrared photography, a meteorological data archive for four outlying weather stations on University farms and files of the State Climatologist for Maryland.

The Department of Meteorology has a modern teaching laboratory in which educational color video tapes and 16 mm films may be produced and replayed. Sufficient equipment is installed to allow students and faculty to produce their own educational materials for classroom and seminar use and record special experiments, field trials or lecture events for permanent use.

The Department maintains a specialized library with several hundred text and reference books in meteorology and allied sciences, many specialized series of research reports and many current journals. The campus provides a main library as well as libraries in chemistry, astronomy and engineering. Several excellent government libraries in the area, including the Library of Congress and the NOAA library, also provide an unsurpassed resource.

The Department has installed a UNIDATA computer graphics animation system that ingests, manages and displays current weather satellite, weather radar and weather map data in color for research, instruction and the preparation of videotape or film materials.

The Department of Meteorology has access to a wide spectrum of computer resources, including its own Apollo scientific workstation network with more than 20 nodes, part of which supports Unidata activities. The University's Computer Science Center (CSC), which is located in the same building as the Department, operates an IBM 4381, an IBM 3081 and a Unisys 1100/92. Access to CSC is via high-speed terminals, Ethernet and the Remote Job Entry emulator. Departmental personnel can communicate with various remote supercomputers at high speed through CSC, including the Cray XMP at San Diego Supercomputer Center (a satellite link), the Crays at NCAR (satellite link), the Amdahls and Cyber 205 at Goddard Space Flight Center (9600 baud terminal line) and the many computers attached to GSFC campus network (56 kilobaud land line).

The University of Maryland is located in an area that is rich in a variety of beneficial professional resources. Because of its proximity to the nation's capital, the University of Maryland is able to interact closely with the many governmental groups interested in various aspects of the atmospheric sciences. Guest seminar speakers and visiting

lecturers here are frequently scientists invited from local government laboratories, and the Department faculty often attend and participate in the seminars, colloquia and scientific workshops being held at these neighboring institutions.

A wide spectrum of meteorological interests are represented in the local scientific community. For example, studies are being conducted on analytical techniques for atmospheric chemistry, air pollution calibration standards and the effect of weather and climate on energy supplies and agricultural productivity. There are several groups devoted to climate analysis and simulation, new technique development for long-range forecasting and studies in fluid dynamics. Studies of satellite applications to meteorology, solar and wind energy analyses and prediction of atmospheric diffusion and transport processes are also represented.

The Washington, D.C. chapter of the American Meteorological Society consists of about 400 members who hold professional meetings each month. The Washington, D.C. area is frequently the site of national and international conferences, most notably of the American Association for the Advancement of Science and the American Geophysical Union. Although the University of Maryland is the only school in the region offering degrees in meteorology, there are professional and library resources at several other nearby major universities. In addition to the various government and academic institutions, the Washington metropolitan area contains numerous well-known private contractors and consulting companies involved in meteorology, which provide employment opportunities for students both before and after graduation.

The Department of Meteorology maintains professional interactions with scientists of major federal agencies in the atmospheric, oceanographic, and hydrologic sciences. For example, a formal Memorandum of Understanding with the National Oceanic and Atmospheric Administration provides for the development of special courses by visiting faculty from NOAA as well as opportunities for faculty and students to work on-site at NOAA facilities. Opportunities are also provided for interactions at nearby facilities, including the National Weather Service, the National Environmental Satellite and Data Information Service, the Naval Research Laboratory, the National Institute of Standards and Technology and the NASA Goddard Space Flight Center.

As a member of the University Corporation for Atmospheric Research, the Department enjoys the common facilities offered by the National Center for Atmospheric Research such as research aircraft and supercomputers.

Financial Assistance

Graduate assistantships are available to qualified graduate students. Research assistants carry on research in the areas of global change, synoptic and dynamic meteorology, satellite meteorology, climate dynamics, air pollution, atmospheric chemistry, theoretical fluid dynamics, atmospheric radiation, general circulation, oceanography and biosphere-atmosphere interactions. Fellowships are also awarded by the Graduate School to the most qualified applicants. In addition, hourly employment is available in the Department and off campus. Stipends are maintained at a competitive level.

Additional Information

Application material or additional information may be obtained by writing:

Chair, Admissions Committee
Department of Meteorology

University of Maryland
College Park, MD 20742
(301) 405-5373
For courses, see code METO.

Microbiology Program (MICB)

Professor and Chair: Hetrick

Professors: Colwell, Cook, Joseph, Roberson, Weiner, Yuan

Professors Emeritus: Doetsch, Faber, Pelczar

Associate Professors: MacQuillan, Robb[1], Stein, Voll

Assistant Professors: Benson, Capage

Instructor: Smith

[1]Joint appointment with Center of Marine Biotechnology

NOTE: Some courses in this program may require the use of animals. Please see the Statement on Animal Care and Use in the appendix and the policy statement for students under "Degree Requirements

The Department of Microbiology offers programs leading to the Master of Science and Doctor of Philosophy degrees with special emphasis in the biomedical, environmental and biotechnology areas. In the biomedical area, a student may specialize in virology, immunology or medical bacteriology. Environmentally related research projects are concerned with microbial ecology, marine microbiology, diseases of finfish and shellfish, and biodegradation of pollutants. Molecular studies involve bacterial and yeast genetics, genetic engineering, cellular immunology, immunochemistry, molecular systematics, DNA repair systems and the control of bacterial morphogenesis. Many of the faculty are affiliated with federal and industrial laboratories in the greater Washington area.

Advanced degree graduates in microbiology are in demand, particularly in specialties involving recombinant DNA technology, immunology, virology-tissue culture, ecology, fermentation and medical microbiology. Positions become available in both the public and private sector and may involve research, quality control and/or product development.

Admission and Degree Information

Qualified students are accepted in either the M.S. or Ph.D. programs. Applicants for graduate programs must have acquired a thorough foundation in biological and physical sciences. A strong background in microbiology is desirable but not essential. However, a lack of specific courses may lengthen the time required to earn a degree. Scores on both the General Test and the Subject Test in Biology of the Graduate Record Examination (GRE) must accompany applications.

Requirements for the M.S. degree include a minimum of 24 semester hours exclusive of research credits. A written thesis based upon research is required, and all candidates must pass a final oral examination given by an advisory committee. All candidates for graduate degrees must serve as laboratory teaching assistants for at least one semester per degree. Candidates normally require about two years to complete the M.S. program, but quality of performance alone determines the awarding of the degree.

Candidates for the Ph.D. degree must successfully complete a core curriculum consisting of eight semester-hour credits in Microbiology graduate courses, including Microbial Metabolism, Immunology, Virology and Genetics. These courses may be satisfied by lateral transfer of equivalent credit or by evidence of competence in these areas. Two credits of graduate seminar or special topics course per year is required after admission to candidacy. A student's dissertation committee will decide what additional coursework, if any, is required. Twelve credits of doctoral research (MICB 899), exclusive of other required courses, must be taken while enrolled for the degree.

Application for advancement to candidacy can be made after the following sequence: (1) The preparation and defense of a written research proposal on a topic chosen by the Graduate Program Committee; and (2) submission of a written proposal on planned doctoral research and its defense before the student's graduate dissertation committee. A student must be a candidate for at least one full year before the defense of the dissertation and graduation.

Facilities and Special Resources

Well-equipped laboratories are available for the conduct of modern molecular biology and for support of a variety of faculty research efforts. Special resources include a state-of-the-art electron microscopy facility housing two scanning/transmission scopes with image analysis capabilities, centralized animal facilities, computer support, a fluorescence-activated cell sorter, fermentation equipment and a P3 biohazard containment laboratory.

Financial Assistance

A number of teaching assistantships, research assistantships and fellowships are available. The number varies and in part is contingent on faculty research support, but most full-time students in the department receive assistantships or some other form of financial support.

Additional Information

Interested individuals may request an information brochure describing in detail the program of graduate study in microbiology. For information contact:

Chair, Graduate Program Committee
Department of Microbiology
University of Maryland
College Park, MD 20742
(301) 405-5435
For courses, code MICB.

Molecular and Cell Biology Program (MOCB)

Professor and Director: Vijay

Professors: Armstrong, Colombini, Dunnaway-Mariano, Gerlt, Hansen, Kozarich, Kuenzel, Kung, Levitan, Mather, Ottinger, Solomos

Associate Professors: Angle, Deitzer, Dutta, Goode, Ma, Regier, Snyder, Sze, Wolniak

Assistant Professors: Hutcheson, Julin, Payne, Samal, Shapiro, Vakharia, Watson

The Graduate Program in Molecular and Cell Biology offers study leading to the Doctor of Philosophy degree. It is an interdepartmental program involving the de-

partments of Botany, Chemistry and Biochemistry, Entomology, Microbiology and Zoology in the College of Life Sciences, the departments of Agronomy, Animal Sciences, Horticulture and Poultry Science in the College of Agriculture, Virginia-Maryland Regional College of Veterinary Medicine and the Center for Agricultural Biotechnology, Maryland Biotechnology Institute.

The Program faculty have a broad spectrum of expertise and represent some of the most outstanding biologists on campus. Many of the faculty are engaged in research that is being supported by extensive extramural grants from regional, national and international agencies. Research on regulation of gene expression during growth, differentiation and reproduction, endocrine-target cell/tissue interactions, ultrastructural-functional relationships, transport mechanisms, vision, signal transduction, photoregulation, host-parasite interactions involving viruses, bacteria and fungi in plants as well as animal hosts, molecular genetics and analysis of protein/enzyme/nucleic acid structure, function and interactions are some of the areas under study. These investigations are being carried out in both eukaryotic and prokayotic systems.

The Program in Molecular and Cell Biology has only recently been established at the College Park campus. A curriculum of courses is presently being developed for the Program and should be in place for Fall 1990. It will consist of core courses in biochemistry, cell and molecular biology and molecular genetics. Laboratory courses will include training in research methodologies in molecular and cell biology including recombinant DNA technology and rotation through the faculty's research laboratories. Additional advanced level courses in specialty areas and topical subjects will offer electives tailored to the development and needs of students affiliated with individual home departments. A research seminar presented by faculty, advanced level students and invited scientists who are authorities in their chosen areas of expertise will be required. Other requirements including a prelim examination, admission to the candidacy, an original research project and a defense of dissertation research will be included in the curriculum.

Admission Information

Admission to the Graduate Program is competitive. Candidates must satisfy the Graduate School requirements and submit the following: (1) copies of diplomas of previous degree(s); (2) transcripts of previous college work; (3) statement of purpose and professional objectives; (4) three letters of recommendation from persons competent to judge the applicant's abilities and aptitude for graduate work; (5) scores of the Graduate Record Examination Aptitude Test; and (6) for international students, a score of the Test of English as a Foreign Language (TOEFL). The Admissions Committee may require the student to take remedial courses if he or she enters with inadequate prerequisites or deficiencies in a previous program of study.

Facilities and Special Resources

Excellent laboratory facilities are available for teaching both upper and advanced level courses in biochemistry, cell and molecular biology and biophysical structural analyses. Extensive facilities for cell culture, monoclonal antibody production, protein and nucleic acid analyses via modern methods such as peptide sequencing, oligonucleotide synthesis and sequencing, fluorescence, scanning and transmission and electron microscopy, computer graphics for molecular modeling, NMR, x-ray diffraction etc. are present in core facilities consisting of the Protein and Nucleic Acid Synthesis and

Analysis (PNA) Laboratory, the Laboratory for Biological Ultrastructural Research, the Cell Technology (Hybridoma) Laboratory, research laboratories of participating departments and the five centers of the Maryland Biotechnology Institute (Center for Agricultural Biotechnology, Center of Marine Biotechnology, Medical Biotechnology Center, Center for Advanced Research in Biotechnology and Center for Bioprocessing and Manufacture).

Financial Assistance

The Program offers fellowships and teaching and research assistantships to admitted students on a competitive basis. Additionally, the Program will recommend outstanding applicants to the Graduate School for its fellowships. When supplemented with matching funds from the Program, these fellowships will enhance the financial support of the awardees at a level much higher than the regular fellowships and teaching and research assistantships.

Additional Information

For specific information on the program, admission procedures, financial support and other details, contact:

Dr. Inder K. Vijay
Program in Molecular and Cell Biology
Animal Sciences Center
University of Maryland
College Park, MD 20742

The Program's courses are being developed and a list will be ready for Fall 1990.

Music Program (MUSC)

Professor and Chair: Major

Associate Chair: Cooper

Professors: Bernstein, Cohen, Cossa, Fischbach, Folstrom, Garvey, Guarneri String Quartet (Dally, Soyer, Steinhardt, Tree), Head, Heifitz, Heim, Helm, Hudson, Johnson, Koscielny, Major, McDonald, Montgomery, Moss, Schumacher, Serwer, Traver, Troth

Associate Professors: Barnett, Davis, DeLio, Elliston, Elsing, Fanos, Fleming, Gibson, Gowen, Mabbs, McCoy, Olson, Robertson, Rodriquez, Ross, Urban, Wakefield, Wexler, Wilson

Assistant Professors: Balthrop, Payerle, Saunders, Sparks

Lecturer: Beicken

Instructor: Walters

The Department of Music offers programs of study leading to the Master of Music degree with specializations in performance, conducting, historical musicology, ethnomusicology, music theory, music education and composition; to the Doctor of Philosophy degree with specializations in historical musicology, ethnomusicology and music theory; and to the Doctor of Musical Arts degree with specializations in performance-literature and in composition. Doctoral programs in music education, offered cooperatively with the College of Education, lead to Doctor of Education and Doctor of Philosophy degrees.

Admission and Degree Information

Admission to graduate degree programs in music is highly selective. It is determined primarily upon a performance audition, tapes and scores of original compositions, scholarly research papers, letters of recommendation, successful teaching experience and, in academic areas, GRE scores.

Students must complete at least 30 semester credit hours for all master's degrees, earning at least one-third in the area of specialization and the remainder in supportive coursework in music and electives. A public recital or performance is required in performance, conducting and music education; a scholarly thesis is required in musicology, ethnomusicology, theory and composition.

Requirements for the Doctor of Philosophy and the Doctor of Musical Arts degrees require no fixed number of earned credits. Rather, they require the satisfactory completion of a significant body of coursework that, in the student and the Graduate Adviser's judgment, prepares the student for the Preliminary Examination that leads to the Admission to Candidacy.

Libraries and Special Research Resources

The University of Maryland, College Park offers musical scholars a variety of libraries, archives, special collections and other research resources that few universities equal.

The music library in Hornbake Library is maintained as a separate branch within the University's library system. Its main collection consists of approximately 22,000 books, 70,000 scores, 2,200 microfilms, 3,500 microfiches, 45,000 phonodiscs, 3,000 tapes and 2,400 piano rolls along with readers for all microforms, listening facilities for discs and tapes, and equipment for making photographic, microfilm, microfiche or xerographic copies.

Special collections of particular musical interest are (1) the Jacob M. Coopersmith Collection consisting of his working library, which is rich in Handel materials (books, music, journals, reprints of articles, etc.); (2) microfilms of all Handel autographs at the British Library and the Fitzwilliam Museum, and of almost all other known autograph fragments of Handel's music; (3) the Alfred Wallenstein Collection, donated by the violoncellist and conductor, comprising the performance library (about 28,000 titles) of radio station WOR in New York City and dating through the early 1950s; (4) Andre Kostelanetz's own working collection of orchestral scores and parts in manuscript, about 4,000 titles bequeathed by the conductor; (5) the archives of the American Bandmasters Association, the Music Educators National Conference, the National Association of College Wind and Percussion Instructors, the International Clarinet Society, the College Band Directors National Association and the Music Library Association, among which is the oral history collection; the press books of Edwin Franko Goldman; an extensive gathering of clippings, programs, photographs and historic recordings relating to the history of the American band movement; the Contemporary Music Project Library of the Music Educators National Conference; the Pillsbury Foundation School archives; the Frances Elliott Clark papers; the Luther Whiting Mason Collection; and the music education textbook collection; and (6) the International Piano Archives at Maryland (formerly the International Piano Library of New York City), which is a unique collection of tapes, phonodiscs, piano rolls, music scores, cylinders,

record catalogues and manuscripts documenting the entire history of recorded piano literature and its performance.

Also located at The University of Maryland is The Center for Studies in Nineteenth-Century Music. The Department's research activities include the C.P.E. Bach Edition and the American Handel Society.

Within a few minutes of the College Park campus are research opportunities offered by the Library of Congress, the Folger Shakespeare Library, Dumbarton Oaks, the National Archives, the Smithsonian Institution, the Enoch Pratt Free Library of Baltimore and about 500 specialized libraries.

Special Resources

The Department schedules a wide variety of student and faculty solo and ensemble recitals and concerts, including those of the internationally recognized Guarneri Quartet, which is in residence at College Park. The Department also cooperates with the campus in a year-long series of University Community concerts and in the summer International Piano Festival and William Kapell Competition. The University also sponsors an annual three-day Handel Festival that features the University of Maryland Chorus and scholars and performers from around the world. The musical environment of the entire Washington-Baltimore area is unusually varied and rewarding in performances at the John F. Kennedy Center for the Performing Arts, Constitution Hall, the National Gallery of Art, the Phillips Collection, the Library of Congress, Wolf Trap Farms Park, Smithsonian Institution, the Corcoran Gallery of Art and Joseph Meyerhoff Symphony Hall in Baltimore.

Financial Assistance

A number of competitive fellowships, tuition waivers and assistantships are available. Preference may be given to those who have filed an application for admission to the University and have been officially admitted by February 1.

Additional Information

Music at Maryland: Graduate Programs provides descriptive information, details of course requirements, examination procedures and graduation requirements for the M.M., Ph.D. and D.M.A. degree programs. Specific information may be obtained from:

Dr. Norman Heim
Director of Graduate Admissions
Department of Music
Tawes Fine Arts Building
The University of Maryland
College Park, Maryland 20742
(301) 405-5870

For courses, see code MUSC.

Nuclear Engineering Program (ENNU)

Professor and Director: Munno

Professor and Department Chair: Roush

Professors: Hsu, Silverman

Associate Professors: Almenas, Modarres, Pertmer

Assistant Professor: Mosleh

Lecturers: Ebert, Graves, Lee, Rahejah, White

Housed in the Department of Chemical and Nuclear Engineering, the Nuclear Engineering program's primary objective is to maintain and extend the ever- increasing degree of engineering sophistication. The courses and research programs strive to create an atmosphere of originality and creativity that prepares the student for future engineering leadership.

The student, his or her adviser and the department head establish an individual plan of graduate study compatible with the student's interests and background. General areas of concentration include reactor safety, reactor thermal hydraulics, transport theory, activation analysis, probalistic risk assessment, reliability analysis, reactor physics, radiation engineering, integrated thermal hydraulic effects and nuclear core design. The general nuclear engineering program is focused toward energy conversion and power engineering with additional specialties in radiation and polymer science and reliability analysis.

Admission and Degree Information

The programs leading to the Master of Science and the Doctor of Philosphy degrees are open to qualified students holding bachelor's degrees in any of the engineering and science areas from accredited programs, but in some cases it may be necessary to require courses to fulfill the background. The Graduate School admission requirements apply in reviewing applications.

The M.S. degree program offers both the thesis or non-thesis option. The equivalent of at least three years of full-time study beyond the B.S. degree is required for the Ph.D. degree. All students seeking graduate degrees in Nuclear Engineering must enroll in ENNU 620, 630 and 440. Many of these courses are offered in the late afternoon and evening for part-time students. In addition to the Graduate School rules, the Department sets forth certain special degree requirements in its publications.

Facilities and Special Resources

Special facilities available for graduate study in Nuclear Engineering include the nuclear reactor, a large scale integral thermal hydraulic facility a large gamma source, an 8 MeV Electron Linear Accelerator, and various analyzers and detectors. The nuclear reactor is a 250 KW swimming pool type using enriched uranium. In addition, there are considerable computer and graphics facilities available, including Sun Workstations.

Additional Information

For more specific information, contact:

Director of Graduate Studies
Nuclear Engineering Program

Chemical and Nuclear Engineering Building
University of Maryland
College Park, MD 20742
(301) 405-5208

For courses, see code ENNU.

Nutritional Sciences Program (NUSC)

Professor and Chair: Ahrens

Professors: Doerr, Heald, Kuenzel, Mather, Max, Moser-Veillon, Prather, Read, Soares, Thomas, Tildon, Vandersall, Vijay, Westoff

Professor Emeritus: Keeney

Associate Professors: Castonguay, DeBarthe, Douglass, Erdman, Hansen, Roeder, Russek-Cohen, Sampugna

Assistant Professors: Alston-Mills, McKenna, Mench, Taylor

The Graduate Program in Nutritional Sciences offers study leading to the Master of Science and the Doctor of Philosophy degrees. It is an interdepartmental program involving faculty from the Departments of Animal Sciences, Chemistry and Biochemistry, Human Nutrition and Food Systems, and Poultry Science on the College Park campus; Pediatrics at the University of Maryland, Baltimore City campus; and Human Ecology at the University of Maryland, Eastern Shore campus. In addition, there are affiliated scientists interacting with the program at federal laboratories in the USDA, FDA, NIH and Smithsonian Institution-National Zoological Park. Degree recipients in NUSC are employed equally in academia, government service or the private sector. This program emphasizes the basic science aspects of nutrition. For courses, see code NUSC.

Philosophy Program (PHIL)

Professor and Chair: Campbell

Professors: Bub, Devitt, Greenspan, Lesher, Martin, Pasch, Slote, Suppe, Svenonius

Professor Emeritus: Schlaretzki

Associate Professors: Brown, Celarier, Cherniak, Darden, Johnson, Levinson, Odell, Rey, Stairs

Assistant Professors: Horty, Taylor

Affiliate Associate Professor: Hornstein

The Department of Philosophy offers graduate study leading to the Master of Arts and Doctor of Philosophy degrees with emphasis on contemporary Anglo-American philosophy and philosophy's interaction with other disciplines. Students normally enter the doctorate program without an M.A. degree, but the M.A. may be earned on the way to the Ph.D. While the Ph.D. program is suitable primarily for students who wish to enter a career in teaching and research at the college or university level, the M.A. program is appropriate for those who want to deepen and expand the knowledge they gained as undergraduates or who wish to develop competence in philosophy to apply to some other professional field.

In cooperation with the Department of History and under the supervision of the Committee on the History and Philosophy of Science, a special interdisciplinary cur-

riculum in the history and philosophy of science is also offered at the M.A. and Ph.D. levels.

In addition, the Department of Philosophy offers a specialized curriculum in cognitive studies at the M.A. and PhD levels under the supervision of the Committee for Cognitive Studies in Philosophy and in cooperation with the Department of Computer Science, the Department of Linguistics and the Department of Psychology.

The Institute for Philosophy and Public Policy, under the auspices of the School of Public Affairs, engages in research, teaching and curriculum development in the ethical and conceptual issues in public policy formation. The Center offers graduate students opportunities for coursework and research.

The Department sponsors a series of colloquia by visiting and local speakers throughout the academic year.

Admission and Degree Information

Students who seek admission to the Ph.D. program should intend to pursue only full-time study toward that degree. Candidates with a high grade point average should normally have completed at least 18 credit hours (or the equivalent) of philosophy, including one course in logic, two courses in the history of philosophy and two courses from ethics, epistemology or metaphysics. The Department also requires for admission a Graduate Record Examination Aptitude Test score, three letters of recommendation from previous instructors, at least one of whom is familiar with the applicant's work in philosophy and a sample of the student's written work on a philosophical topic. The GRE score, letters and work sample should be sent directly to the Department of Philosophy.

A candidate may be admitted to the curriculum in the History and Philosophy of Science or Cognitive Studies in Philosophy with fewer than 18 hours in philosophy if the student has a strong background in science or in a cognate discipline in cognitive studies, respectively. For details, consult the Chairperson of the Committee on the History and Philosophy of Science or of the Committee for Cognitive Studies in Philosophy.

M.A. admission requirements are less stringent than those for admission to the Ph.D. program, but the same supporting documents must be provided.

The M.A. program offers both a thesis and a non-thesis option. Candidates who pursue either option must demonstrate competence in symbolic logic and knowledge of modern philosophy. There are no specific course requirements beyond the Graduate School requirements. The individual student's research determines whether foreign language skills are required. For the non-thesis option, a student must pass a written comprehensive examination and must submit a collection of papers demonstrating competence in philosophical research and writing.

In addition to the Graduate School requirements, Ph.D. students in the regular philosophy program are required to demonstrate a competence in three philosophical fields selected from four broad philosophical areas: History of Philosophy, Epistemology and Metaphysics, Logic and Philosophy of Science and Value Theory. Students demonstrate a competence by writing papers of substantial breadth and scope that indicate the student's grasp of some important problems in the field and connections to other issues in that field. These demonstrations must be completed within six se-

mesters of full-time study. Other requirements include: qualification in symbolic logic, course distribution in the above four philosophical areas and presentation of a research paper at a Departmental colloquium in the latter stages of dissertation research. All Ph.D. students are also required to teach undergraduates for two semesters at an institution of higher learning, normally through the Department's teaching assistantship program.

Foreign language skills are required as demanded by the individual student's research.

Partial credit toward the Ph.D. requirements will be awarded for relevant work done at other graduate institutions. The committee on Graduate Admissions will make a specific determination in each case.

Philosophy students pursuing a Ph.D. in the History and Philosophy of Science are subject to certain special requirements. They must demonstrate competence by examination and written papers in (1) the history of science and the contemporaneous philosophies of science; (2) the philosophy of science and related metaphysical and epistemological problems; and (3) a field of science (for students who do not possess an undergraduate science degree) or an area of philosophy. Coursework must include: (1) courses in the history of science and technology; (2) the philosophy of science; (3) graduate-level courses in an area of science; (4) a course on research methods in history and philosophy of science; and (5) either Philosophy 471 or 478. In addition, the student must demonstrate reading competency in a foreign language, normally French or German.

Students who take the Cognitive Studies Specialization are also subject to certain special requirements. Ph.D. students must include an interdisciplinary field in cognitive studies as one of the three fields of competence. Both Ph.D. and M.A. students must include philosophy courses concerned with issues related to cognitive studies and courses in a secondary area of cognitive studies outside philosophy.

Financial Assistance

The Department administers a number of graduate assistantships. Promising students have a good chance of receiving financial support in the first year and are generally favored for reappointment through the fourth year of studies.

Additional Information

Brochures describing the regular M.A. and Ph.D. programs in philosophy may be obtained by writing to the Committee on Graduate Admissions and Awards, Department of Philosophy. Information concerning the curriculum in the History and Philosophy of Science may be obtained from the Chairperson, Committee on the History and Philosophy of Science. Information concerning the curriculum in Cognitive Studies may be obtained from the Chairperson, Committee for Cognitive Studies in Philosophy.

For courses, see code PHIL.

Physics Program (PHYS)

Professor and Chair: Liu

Professors and Associate Chairs: Bardasis, Boyd

Professors Emeriti: Glover III

Professors: Alley, Anderson, Antonsen, Banerjee, Bhagat, Brill, C.C. Chang, C.Y. Chang, Chant, Chen, Currie, Das Sarma, DeSilva, Dorfman, Dragt, Drake, Drew,

Earl, Einstein, Falk, Ferrell, Fisher, Gates, Glick, Gloeckler, Gluckstern, Goldenbaum, Greene, Greenberg, Griem, Griffin, Holmgren, Hornyak, Hu, Kelly, Korenman, Layman, Lee, Lynn, MacDonald, Mason, Misner, Mohapatra, Oneda, Ott, Paik, Papadopoulos, Park, Pati, Prange, Redish, Richard, Roos, Skuja, Snow, Sucher, Toll, Wallace, Weber, Woo, Zorn

Professors (part-time): Z. Slawsky,

Visiting Professors: Franklin

Adjunct Professors: Boldt, Ramaty, Ripin

Associate Professors: Ellis, Fivel, Goodman, Hadley, Hassam, Kacser, Kim, Kirkpatrick, Wang, Williams

Assistant Professors: Cohen, Hamilton, Jacobson, Jawahery, Skiff

Lecturers: Menella, Rapport, M. Slawsky, Stern, Taggart

The Department of Physics and Astronomy includes programs in many areas of current research interest. Those in astronomy are listed under the heading of Astronomy. Those in the Physics program include: astrophysics, atomic physics, chemical physics, condensed matter physics, dynamical systems, elementary particle theory, fluid dynamics, general relativity, high energy physics, many- body theory, molecular physics, nuclear physics, particle accelerator research, plasma physics, quantum electronics and optics, quantum field theory, space physics and statistical mechanics.

Admission and Degree Information

Because of the large number of qualified applicants, the Department of Physics and Astronomy has had to restrict formal admission to the Graduate School to those who have shown particularly outstanding work in their undergraduate records or who have already done satisfactory work in key senior-level courses at the University of Maryland. Students who have less outstanding records, but who show special promise may be given provisional admission under special circumstances. Regular admission will then depend on the satisfactory completion of existing deficiencies. A faculty adviser will inform each of these students what background he or she lacks and what he or she must accomplish to achieve regular admission. Thus, the Department hopes to offer an opportunity for advanced study in physics to all qualified students.

Students who enter the graduate program are normally expected to have strong backgrounds in physics, including intermediate-level courses in mechanics, electricity and magnetism, thermodynamics, physical optics and modern physics. A student with deficiencies in one or more of these areas may be admitted but will be expected to remedy such deficiencies as soon as possible.

The Graduate Record Examination (GRE), including the Advanced Physics test, is required for admission. In rare instances, this requirement may be waived. The average GRE Advanced Physics test score is 700. A minimum overall score of 550 on the Test of English as a Foreign Language is required of applicants from non- English speaking countries.

The Department offers both a thesis and non-thesis option for its Master of Science programs. The Departmental requirements for the non-thesis option include: at least four courses of the general physics sequence; a paper as evidence of ability to organize and present a written scholarly report on contemporary research; the passing at the

master's level of one section of the Ph.D. qualifying exam; and the passing of a final oral examination.

The thesis option's requirements include at least four courses of the general physics sequence, the graduate laboratory unless specially exempted and the passing of an oral examination including a defense of thesis.

The requirements for the Doctor of Philosophy degree in physics are set in general terms to allow the individual student as much freedom as possible to prepare a course of study suited to individual needs. These requirements are: competence in basic physics indicated by a satisfactory performance on a Qualifying Examination and in the Graduate Laboratory; a paper as evidence of the ability to organize and present a written scholarly report on contemporary research prior to candidacy; advanced course study outside the student's field of specialization consisting of at least two courses (six credits) in physics at the 700 or 800 level and two graduate courses (six credits) outside the physics program (this may include astronomy); PHYS 624 or 625 for students with theoretical theses; and research competence through active participation in at least two hours of seminar, 12 hours of thesis research and the presentation and defense of an original dissertation.

Facilities and Special Resources

Current research in the Department spans an immense range of theoretical and experimental work on the forefront of knowledge, far too large to describe here. For details of the work in the various fields, and the faculty and facilities involved, the Department biannually releases a booklet entitled "Research in Physics" which can be obtained upon request.

Out of the 77 professional faculty members, 66 engage in separately budgeted research; 111 faculty members at other ranks also engage in research. In 1987- 88, 107 graduate students also participated in research under stipends. The current federal support for research amounts to approximately 15.5 million dollars annually, attesting to both the size and the quality of the program.

The Department houses the Center for Theoretical Physics, which provides a means for outstanding theoretical physicists to visit the Department as postdoctoral fellows and visiting faculty members.

There are close academic ties with the Institute of Physical Science and Technology on the campus; members of the Institute supervise graduate research and also teach physics courses. The Department also has ties with the University's Computer Science Center, which provides outstanding computer facilities for the University.

In addition to using College Park campus facilities, graduate students can utilize resources of nearby federal laboratories under certain conditions.

The University of Maryland is located within the metropolitan area of Washington, D.C. where it enjoys the proximity of a large number of outstanding institutions such as NASA's Goddard Space Flight Center, the Naval Research Laboratory, the Naval Surface Weapons Center, the National Institute of Standards and Technology, the Johns Hopkins Applied Physics Laboratory, the Department of Energy, the National Institutes of Health, the Library of Congress and other federal institutions. The Department works closely with certain research groups at some of these institutions. In

order to facilitate graduate study in the Washington area, the Department of Physics and Astronomy has part-time professors in certain government laboratories.

Students who desire to do graduate work in physics at a government agency should contact a member of the graduate faculty in the Department.

Financial Assistance

The Department offers both teaching and research assistantships. In 1989-90 approximately 85 teaching assistants and 107 research assistants worked in the Department. Summer research stipends for advanced graduate students are customary, and a few summer teaching assistantships are available.

The deadline for applications for financial support is February 1 for assistantships and fellowships.

Graduate students also can seek full-time or part-time employment in the many government and industry laboratories located within a few miles of the campus.

Additional Information

A booklet is available regarding the graduate program in physics. "Graduate Study in Physics" is a guidebook to procedural requirements and rules concerning the acquisition of higher degrees. "Research in Physics" describes the program's research activities and lists personnel involved. It gives the names of faculty and graduate students involved in various research projects, together with brief descriptions of those projects. For more information, contact:

Mrs. Jean Clement, Secretary
Graduate Entrance Committee
Department of Physics
University of Maryland
College Park, MD 20742
(301) 405-5982

For courses, see code PHYS.

Poultry Science Program (POUL)

Associate Professor and Acting Chair: Doerr

Professors: Heath, Kuenzel, Ottinger, Soares, Thomas

Associate Professors: Murphy, Wabeck

Adjunct Professor: Kotula

Adjunct Associate Professor: Failla, Rattner

Assistant Professor: Mench

NOTE: Some courses in this program may require the use of animals. Please see the Statement on Animal Use and Care in the appendix and the policy statement for students under "Degree Requirements."

The Department of Poultry Science offers graduate study leading to the Master of Science and the Doctor of Philosophy degrees. The student may pursue a graduate degree specializing in biotechnology, ethology, nutrition, physiology, technology of eggs and poultry, value-added products or toxicology.

There are many job opportunities for graduates in government research, industry or academia.

Admission and Degree Information

In addition to Graduate School and Departmental requirements, the Department also requires submission of Graduate Record Examination (GRE) results. Copies of requirements can be obtained from the Department.

Facilities and Special Resources

The Department has excellent facilities for broilers, layers, quail and mice (for hybridoma research). Laboratories are modern and well-equipped with instruments such as: an amino acid analyzer, atomic absorption spectrophotometer, scintillation counters, gas chromatographs, HPLCs, Instron food analyzer, Grass polygraph, EIA reader, fluorescence and light microscopes, etc. Specialized laboratories provide research capability in microbiology, molecular biology, nutrition, physiology and tissue culture. Students can also conduct research at an on-campus poultry farm. In addition, a new off-campus research facility in the heart of Maryland's poultry industry permits field studies and interaction with industry-based research.

Financial Assistance

Graduate research assistantships and teaching assistantships are available.

For courses, see code ANSC and others.

Psychology Program (PSYC)

Professor and Chair: Goldstein

Professors: Anderson, Brauth, Dies, Dooling, Fretz, Gelso, Gollub, Hall, Hill, Hodos, Horton, Kruglanski, Locke, Lorion, Magoon[1], Martin, McIntire, J. Mills, Penner, Pumroy, Schneider, Scholnick, Sigall, B. Smith, Steinman, Sternheim, Trickett, Tyler

Associate Professors: Allen, R. Brown, Coursey, Freeman[2], Guzzo, Larkin, Norman, O'Grady, Steele

Assistant Professors: Alexander, Hanges, Helms, Johnson, Klein, Plude, Stangor

[1]Joint appointment with Business and Management
[2]Joint appointment with Counseling and Personnel Services

NOTE: Some courses in this program may require the use of animals. Please see the Statement on Animal Use and Care in the appendix and the policy statement for students under "Degree Requirements."

The Department of Psychology offers training leading to the Doctor of Philosophy degree. The number of graduate students is limited by Departmental ruling to a ratio of four resident students per member of the Graduate faculty, ensuring close and intimate contact in research and seminars.

Programs leading to the Doctor of Philosophy degree are offered in the areas of clinical, counseling, experimental, industrial, applied developmental psychology and social psychology. The experimental area is further subdivided into three fields of study: biopsychology, cognitive and psycholinguistics, and sensory and perceptual processes. Many fields have a range of subspecialties (e.g., engineering psychology) in which the student may concentrate. The Department's doctoral programs in both Clinical and Counseling Psychology have been approved by the American Psychological Association.

Admission and Degree Information

The Department accepts only those applicants who have demonstrated superior aptitude and appear capable of completing the requirements for the doctoral degree. All of the specialty areas offer doctoral level programs and do not accept students who are interested in terminal Master of Arts degrees. The average scores of students admitted for the 1989-90 academic year were: GRE V + Q 1300, GRE Psychology 600, GPA 3.7, Psychology GPA 3.8. The Department of Psychology encourages applications from minority groups and women.

Applicants must submit applications each year by January 1 (preferably December 1) for entrance the next fall because available spaces are usually filled early.

A minimum of 72 credit hours beyond the B.A. is required for a doctoral degree. All students who enter with a B.A. are required to take two courses in statistics and five courses in areas outside their specialty program. These five courses must be core courses designed to provide basic information in a variety of specialty areas.

The remaining credit hours (approximately 50 hours) are devoted to research and coursework in the participant's specialty program. If the student chooses a second specialty, two advanced courses along with one core course may be taken in one coherent area.

While the course of study in the Department of Psychology is at the doctoral level, most students choose to earn the M.A. or M.S. degree en route to the Ph.D. The M.A. or M.S. degree requirements are 30 hours of coursework including the two courses in statistics and three core courses. A research thesis is also required. Advancement to the third and the fourth year of doctoral level work is based upon satisfactory completion of core courses, work in the student's specialty area and completion of a research requirement.

Facilities and Special Resources

The Department is housed in a large modern building with facilities designed by the Department's faculty for training graduate students. In addition, its geographic location in a suburb of Washington, D.C. makes accessible a wide variety of laboratory and training facilities in governmental and other agencies, as well as many prominent psychologists.

Financial Assistance

The Department gives financial aid to almost all incoming students. The Department of Psychology does not offer a part-time program. Students are required to attend classes, take part in research and teach as graduate assistants. Each of these assignments is considered a critical part of the graduate training program. It is not possible to obtain this type of education on a part-time basis. Thus, students are not permitted to hold off-campus jobs unless they are under the direct supervision of the faculty.

Additional Information

Additional information concerning the graduate program including specific program brochures and application materials may be obtained by writing:

Graduate Secretary
Department of Psychology - Room 1220
University of Maryland

College Park, MD 20742-4411
(301) 405-5865
For courses, see code PSYC.

School of Public Affairs (Public Management and Public Policy Programs) (PUAF)

Professor and Dean: Nacht

Professors: Baily, Brown, Destler, Galston, Kelleher, Levy, Schelling, Schick, Young

Assistant Professors: Cohen, Cronin, Fetter, Hedman

Lecturers: Ards, Badgett, Slater

The School of Public Affairs provides graduate-level, professional education in five disciplines: accounting, statistics, economics, politics and ethics. Students specialize in issues of government/private sector interaction, social policy, international security, environmental policy or public sector financial management. The program is open to pre-career and mid-career graduate students and builds on the School's location in the Baltimore/Washington corridor.

Admission and Degree Information

The School offers three degrees: the Master of Public Management (MPM) the Mid-Career Master of Public Policy (MPP) and a small Ph.D. program in policy studies. The School also offers joint degree programs with the School of Business (MPM/MBA) and the Law School (MPM/JD). In addition, several non-degree certificates are available.

Master of Public Management

The MPM is a two-year, 51 credit, full-time professional degree combining a rigorous applied course of study with practical experience.

About 35 students enter the program each fall. Although this number is small, the candidates come from a wide variety of undergraduate schools and majors. The average undergraduate GPA is approximately 3.4 and the average GRE score is 620. All students are required to have successfully completed college level math before they enter the School.

During the first year, students fulfill the core requirements that emphasize the tools of policy analysis: financial management, statistics, economics, politics and ethics. They are also introduced to the policy-making process and national, state and local policy makers. In addition to these core courses, first-year students take two elective courses during the second semester.

During the summer between the first and second year, students are employed in federal, state or local government agencies or in private firms that deal extensively with government agencies. In addition to practical experience and the opportunity to use the skills acquired during the first year, this opportunity provides contacts and relationships useful for future projects and job placement.

During the second year students specialize in one of five concentrations: Public Policy and Private Enterprise, Public Sector Financial Management, Environmental Policy, National Security Studies or Social Policy.

Each concentration requires participation in a project course in which students work individually or in small groups conducting research on problems of interest to themselves and the government agency or private firm that sponsors them.

Master of Public Policy

The MPP is a 36-credit degree program designed for mid-career students. This program helps individuals in the middle stages of their careers to update their understanding of today's complex public issues and to move into positions of greater authority and responsibility.

The typical MPP candidate has worked in the public or public-related sector for a minimum of three years and is capable of handling a rigorous academic program and excelling in his/her professional career. Candidates enter the School with varied academic and professional backgrounds. Most have at least a 3.0 undergraduate GPA and have completed some college-level math and economics courses. If candidates do not have these courses in their background, admission may be contingent upon the successful completion of appropriate coursework.

The MPP degree consists of two components: the core curriculum in Methods of Policy Analysis and a selected area of concentration in Public Sector Financial Management, Public Policy and Private Enterprise, Environmental Policy, National Security Studies or Social Policy.

Courses are offered throughout the day and late evening. Students are usually able to finish the degree in a maximum of three years by taking two courses each fall and spring semester, but they are allowed to accelerate their progress if they wish to do so.

Master of Public Policy candidates may also be considered for the ***Mid-Career Fellowship Program.*** Under the joint auspices of the School, various federal agencies and state and local governments, this program recognizes high potential employees for accelerated career development and education. Fellows participate in the Master of Public Policy degree program as well as a professional development series, which includes special seminars, guest speakers and a management development retreat.

Ph.D. in Policy Studies

The School of Public Affairs Ph.D. in Policy Studies is directed at individuals who have received a Master of Public Management or Master of Public Policy degree from the School of Public Affairs, or a similar degree from a program comparable in content and quality to the School's program. Admission is also open to individuals with a distinguished academic record who are in their final year or have completed a master's degree program in a public policy related subject such as economics, political science, statistics, physics or philosophy.

Ph.D. candidates are expected to maintain full-time student status until they have passed the core exams, and the draft dissertation prospectus has been approved. This process is expected to take between one and two full years.

Ph.D. candidates are expected to complete six examinations:

(a) three core examinations designed to test a candidate's knowledge at the master's level in the School's core curriculum;

(b) two specialized field examinations containing both oral and written components;

(c) a final examination on the candidate's dissertation prospectus.

A faculty member at the School must agree to serve as the Ph.D. applicant's academic sponsor in the program. To facilitate the selection of a sponsor, applicants should include as part of their application a description of the general areas in which they want to study and write their dissertation.

Certificate Programs

The School offers 18 credit (6 courses) Certificate Programs in four areas: Methods of Policy Analysis, Public Policy and Private Enterprise, Public Sector Financial Management, Public Management and National Security Studies.

MBA/MPM Joint Program

The campus' College of Business and Management and the School of Public Affairs offer a joint program of studies leading to MBA and MPM degrees. Under the terms of the joint program, a student may earn both degrees in approximately five to six semesters. The accelerated program is possible because some courses can be credited toward both degrees. Candidates must be admitted to both programs separately.

Under the joint program, 66 credits are required for graduation, split roughly equally between the programs. Grade point averages in each program will be computed separately and students must maintain minimum standards in each school to continue in the program. A student must complete both programs satisfactorily in order to receive both degrees. A student whose enrollment in either program is terminated may elect to complete work for the degree in which he or she remains enrolled, but such completion must be upon the same conditions as required of regular (nonjoint program) degree candidates. Student programs must be approved by the Assistant Dean of the School of Public Affairs and the MBA Program Director. For further discussion of admission and degree requirements, students should see the admissions requirements for each program.

MPM/JD Joint Program

The School of Public Affairs and the School of Law, which is located on the University of Maryland at Baltimore campus, offer a joint program of studies leading to MPM and JD degrees. Under the terms of the joint program, a student may earn both degrees in four academic years. The accelerated program is possible because some courses can be credited toward both degrees. Candidates must apply for admission to the Law School as well as the Graduate School at College Park and must be admitted to both programs.

Under the joint program, 75 credits in the Law School coupled with 39 credits in the School of Public Affairs are required for graduation. Grade point averages in each program will be computed separately and students must maintain minimum standards in each school to continue in the program. A student must complete both programs satisfactorily in order to receive both degrees. A student whose enrollment in either program is terminated may elect to complete work for the degree in which he or she remains enrolled, but such completion must be upon the same conditions as required of regular (non-joint program) degree candidates. Student programs must be approved by the deans of each school. For further discussion of admission and degree requirements, students should see the above and consult the entry in the University of Maryland School of Law catalog.

Financial Assistance

The School has financial aid available in the form of fellowships and graduate assistantships. All qualified applicants are considered.

Additional Information

For additional information, contact:

The Assistant Dean for Student Affairs
School of Public Affairs
2106 Morrill Hall
University of Maryland
College Park, MD 20742
(301) 405-6330

For courses, see code PUAF.

Public Communication Program (PCOM)

Associate Professor and Director: Klumpp

(JOUR) Professors: Beasley, Blumler, Cleghorn (Dean, College of Journalism), J. Grunig, Gurevitch, Hiebert, Levy, Martin (Emeritus) ***Associate Professors:*** Barkin, Stepp, Zanot ***Assistant Professor:*** L. Grunig

RTVF: Professors: Aylward, Ferguson, Gomery, Kolker ***Associate Professors:*** Blum, Kirkley, Weiss

SPCH: Professors: Fink, Solomon, Wolvin ***Associate Professors:*** Falcione, Freimuth, Gaines, Klumpp, McCaleb

THET: Professors: Gillespie, Meersman, Pugliese (Emeritus)

The program in Public Communication provides disciplinary or cross-disciplinary doctoral study in Radio-Television-Film, Speech Communication, Theatre and Journalism (Master's work in these disciplines is offered through the RTVF, SPCH, THET and JOUR graduate programs). The program prepares students for rigorous research through instruction in ways to think innovatively about problems in public communication.

Many students concentrate their studies in one of the disciplines associated with the program while others combine perspectives of a number of the disciplines. Individual programs result in a number of specific research areas: audience behavior; advertising; organizational communication; public relations; mass media theory; political communication; health communication; instructional communication; rhetorical theory and criticism; international and cross-cultural communication; communication law and press freedom; broadcasting history, criticism and theory; documentary film and television; theatre history and criticism; public affairs; persuasion, cognition and communication; research methods; or visual communication. Students' programs often combine a number of specialties such as political and governmental communication, public relations and organizational communication, science and health communication, cross-cultural and international propaganda, international communication and comparative media systems, communications law and critical studies of communication. The range of choices reflects the flexibility available within the public communication program.

Employment opportunities include: careers as communication specialists in business, industry or government; careers in journalism, theatre or the media; and academic

positions in each of the disciplines. Historical, theoretical, experimental, practical and critical study of communication are among the fastest growing inquiries of the late twentieth century.

Admission and Degree Information

Admission to the program requires a Master's degree, generally in speech communication, radio-television-film, theatre, journalism, public relations, mass communication or related areas. Students with degrees in other areas may complete deficiencies to prepare for study. Students are admitted only for fall semester. GRE scores, samples of scholarly writing, and letters of recommendation supplement general information required for application. Students applying for the program should write the director for more complete descriptions of requirements and procedures for admission.

In addition to a general framework of study, an individualized program approved by a committee of PCOM faculty guides students' preparation for a 12- hour (minimum) preliminary examination. Typical programs for those with prior degrees in communication involve 36-45 hours beyond the master's degree. Following successful completion of the examination, students must complete a major dissertation project contributing significant new knowledge to the study of human communication.

Facilities and Special Resources

The Washington area is among America's outstanding environments for communication research. Students in health communication and science journalism have access to many of the world's leading health professionals at the National Institutes of Health. Students working with historical collections call upon the resources of the Library of Congress, the Folger Shakespeare Library and the extensive archival collections of the National Archives. Students of governmental and political communication draw upon the aural and visual collections of the Library of Congress, the National Archives and the Smithsonian Institution to supplement the constant resource of the executive, congressional and judicial branches of the national government. Students in theatre have the laboratory of the Kennedy Center, the Folger and other classical, mainstream and experimental theatres including the Arena Stage, National Theatre and Fords Theatre. Our faculty and graduate students perform in many theatres throughout the Washington area in addition to our own Tawes and Pugliese Theaters. Those interested in organizational communication and public relations will find many commercial and nonprofit organizations have corporate headquarters in Washington, which provide opportunities for contact and research with communication professionals. Students of journalism and the media arts find Washington a hub for both national and world media.

Among the special support facilities for research on the College Park campus are computer software support in content analysis and experimental statistics, the collection of the Media Resources Center, the Maryland-in-Europe, Europe- in-Maryland program, a state-of-the-art television post-production facility and three fine theaters.

Financial Assistance

Students may apply for graduate assistantships in the various disciplines. Outstanding students may be nominated for appropriate fellowships. Other university financial aid is also available.

Additional Information

The PCOM program is a cross-disciplinary program among four cooperating units. Please correspond with the unit in which you will do your primary work:

James F. Klumpp
Director of Public Communication Program
Director of Graduate Studies
Dept. of Speech Communication
1147 Tawes
College Park, MD 20742
(301) 314-9573

Mark Levy
Director of Graduate Studies
College of Journalism
University of Maryland
College Park, MD 20742
(301) 405-2380

Gene Weiss
Director of Graduate Studies
Dept. of Radio-Television-Film
0202 Tawes
University of Maryland
College Park, MD 20742
(301) 405-6261

Harry Elam
Director of Graduate Studies
Dept. of Theatre
1146 Tawes
University of Maryland
College Park, MD 20742
(301) 405-6676

For courses, see code PCOM.

Radio-Television-Film Program (RTVF)

Professor and Chair: Kolker

Professors: Aylward, Gomery

Associate Professors: Blum, Ferguson, Kirkley, Weiss

Assistant Professors: Brown, Parks, Pecora, Marchetti, Robinson

Lecturer: Lancaster

Instructors: Miller

A student in the Department of Radio-Television-Film may concentrate in a particular area (film or broadcasting, for example) or elect a more general program covering the multiple aspects of electronic and film communication. Students whose academic goals extend beyond the Department of Radio-Television-Film may, upon approval of their adviser, take as many as 12 credit hours in cognate fields in other departments of the University. Examples of such programs would include educational uses of media, broadcast management and electronic journalism.

Admission and Degree Information

For admission to the graduate program, the applicant must meet all requirements of the Graduate School and, normally, provide acceptable Graduate Record Examination scores. If applicants do not have the equivalent of an undergraduate major in their feild of interest, opportunities exist for them to take coursework in preparation for subsequent admission.

The Department offers the Master of Arts degree with thesis and non-thesis options. Along with the minimum requirements established by the Graduate School, RTVF has special requirements. For more admission and degree information on the Ph.D. program, see the Public Communication Program section of this catalog.

Facilities and Special Resources

The University of Maryland is within a few miles of the Library of Congress, the National Archives, the Federal Communications Commission, the Broadcast Pioneers Library and more than 50 specialized libraries and institutions. Graduate students also have access to studio quality audio, video and film production facilities, and 16mm, 35mm and video projection.

Financial Assistance

The Department awards the Eaton Graduate Fellowship in Broadcasting to one high-ranking gradute student and offers both teaching and research assistantships as well. The Department also nominates outstanding students for University fellowships.

Additional Information

For more specific information, please contact:

Chair
Department of Radio-Television-Film
0202 Tawes Fine Arts Building
University of Maryland
College Park, MD 20742
(301) 405-6261

For courses, see code RTVF.

Recreation Program (RECR)

Professor and Acting Chair: Iso-Ahola

Professor: Humphrey

Associate Professors: Churchill, Kuss, Strobell, Verhoven

Lecturers: Annand

The Department of Recreation offers the Master of Arts degree with a thesis or non-thesis option, and the Doctor of Philosophy degree. Individual academic needs can be met in various areas such as: administration, therapeutic recreation, program planning, natural interpretation, resource planning and management, tourism and commercial recreation, and analysis of leisure behavior. The advanced studies program is designed to assist professional practitioners in the leisure services field and to prepare those who wish to enter the teaching and research profession, government, institutional and community services.

Admission and Degree Information

The Department strongly encourages both master's and doctoral students to have had full-time work experience in leisure services prior to applying for admission. All Ph.D. applicants are required to complete an interview with at least one faculty member. Doctoral students must complete core coursework in recreation/leisure studies and the chosen theoretical area as well as research methods, statistics and computer science. Master's students must produce a thesis or project, and doctoral students must complete a dissertation.

Facilities and Special Resources

Recreation students have access to the University's McKeldin Library, the College's Research Laboratory and statistical resources, the Computer Science Center, the almost

unlimited facilities and programs of the metropolitan areas of Baltimore and Washington, D.C. and the headquarters and offices of appropriate national organizations, agencies and federal governmental units in the nation's Capital.

The Department sponsors a Leisure Research Unit that develops, supports and coordinates a broad-based research effort by faculty and students that addresses phenomena dealing with leisure behavior of individuals and groups. A Department Field Service Unit has been established to develop and coordinate the professional service activities of the Department in response to needs identified in cooperation with the leisure services agencies/institutions of the metropolitan area, state and region. The Department also works cooperatively with the Center on Aging in promoting research, course offerings and training programs.

Financial Assistance

A limited number of teaching and research assistantships are available to qualified graduate students.

Additional Information

For additional information about specific requirements, please contact:

Dr. Seppo Iso-Ahola, Graduate Coordinator
Department of Recreation
The University of Maryland
College Park, Maryland 20742
301) 405-2461

For courses, see code RECR.

Reliability Engineering Program (ENRE)

Professor and Director: Roush

Associate Professor: Modarres

Assistant Professor: Mosleh

Adjunct Faculty: Jones, Raheja, Weiss

Affiliated Faculty: (ENAE) Professor: Chopra; ***Associate Professor:*** Barlow; **(ENCE)** ***Associate Professor:*** Ayyub; **(ENCH)** Professor: Asbjornsen; **(ENEE)** Professors: Frey, Ja'Ja'; Assistant Professors: Fuja, Goldsman; **(ENFP)** Professor: Bryan; **(ENME) Professor:** Dally, Harhalakis, Magrab; ***Associate Professor:*** Pecht; **(ENNU) Professor:** Silverman; ***Associate Professor:*** Pertmer; **(BMGT) Professors:** Ball, Kotz; **(STAT) Professor:** Smith

The interdisciplinary Reliability Engineering Program, administratively part of the Nuclear Engineering Program, offers graduate study leading to the Master of Science and Doctor of Philosophy degrees. An individual plan of graduate study compatible with the student's interest and background is established by the student in consultation with an adviser and the Program Director.

Admission and Degree Information

Students with a Bachelor of Science degree in engineering, physics or mathematics and who achieved a GPA of at least 3.0 on a 4.0 scale are eligible to apply for admission to the program, which is competitive.

In addition to the general Graduate School rules, certain special degree requirements are set forth in program publications.

Financial Assistance

Teaching and research assistantships as well as fellowships and scholarships are available for qualified students. For those reliability engineering students who seek employment in the area, the Program Director will provide assistance.

Additional Information

Requests for further information concerning the program can be obtained by writing:

Director, Reliability Engineering Program
Materials and Nuclear Engineering Unit
University of Maryland
College Park, MD 20742-2115

For courses, see code ENRE.

Russian Language and Literature Program (RUSS) and (SLAV)

Professor and Chair: Pfister

Professor: Brecht

Associate Professors: Berry, Glad, Hitchcock

Assistant Professors: Lekic, Martin

The Russian Section of the Department of Germanic and Slavic Languages and Literatures offers graduate study leading the Master of Arts degree. Specialization includes the following areas: Language, Linguistics and Literature.

Admission and Degree Information

In addition to the Graduate School requirements, candidates should have a bachelor's degree with a major in Russian Language and Literature, Russisan Language and Linguistics or the fluency in the written and spoken language.

The M.A. degree program offers both a thesis and non-thesis option. For the thesis option, the student must complete 24 hours of coursework, the thesis and a written comprehensive examination. The non-thesis option requires 30 hours of coursework, a mini-thesis with oral defense and a written comprehensive examination. For both options the comprehensives consist of four two-hour examinations based on the coursework and the M.A. Reading List.

In addition to its course offerings listed below, the Russian Section of the Department of Germanic and Slavic Languages and Literatures sponsors the Russian Club and the University of Maryland Chapter of Dobro Slovo (the National Russian Language Honors Society). Distinguished scholars and lecturers, as well as visiting professors, visit the metropolitan area and campus regularly. College Park's proximity to Washington D.C. facilitates participation in the many cultural functions of the capital as well as access to research facilities such as The Kennan Institute for Advanced Russian Studies, the Library of Congress, etc.

Financial Assistance

The Russian Section offers graduate teaching and non-teaching assistantships as well as several fellowships.

Additional Information

For further information, write to:
Director of Graduate Studies, Russian Section
Department of Germanic and Slavic Languages and Literatures
University of Maryland
College Park, MD 20742
For courses, see codes RUSS and SLAV.

Sociology Program (SOCY)

Professor and Chair: Falk

Professors: R. Brown, Clignet, Dager, Hage, Janes (Emeritus), Kammeyer, Lejins (Emeritus), Meeker, H. Presser, Ritzer, Robinson, Rosenberg, D. Segal, Teachman

Associate Professors: Finterbusch, Henkel, Hirzel, J. Hunt, L. Hunt, Landry, Lengermann, McIntyre, Pease, M. Segal, Vanneman

Assistant Professors: Harper, Kahn, Neustadtl

Affiliate Professors: Billingsley, Favero, Fink, Gonzalez, Gurevitch, Levy, Loftin, Longest, Wilson

The Graduate Program in Sociology offers coursework leading to the Master of Arts and Doctor of Philosophy degrees. Areas of emphasis in the department include: Demography (with a particular stress placed on gender and equality); Family, Gender and Work; Military Sociology; Political Economy; Social Psychology; Theoretical Sociology.

Within the last three years, about half the students finishing Ph.D. degrees in the Sociology Department have found employment as college-level teachers, and about half are working in research, administration and consulting in federal, state or private organizations. Our location on the edge of the Washington D.C. area offers an unusual number of full-time research opportunities for our graduate students.

Admission and Degree Information

Admission to the graduate program is based upon the student's academic record, GRE scores, letters of recommendation and other information relevant to the applicant's chances of successfully completing the program. Although a previous major in sociology is not required, students entering the master's degree program should have had the following in undergraduate courses: mathematics through college algebra, elementary statistics, sociological theory and sociological research methods. Students entering the Ph.D. program should have had at least one graduate level course each in sociological theory, sociological research methods and statistics. Students deficient in any of these areas may be admitted to the program provisionally, but they must satisfy the requirements during their first year in the program.

Both M.A. and Ph.D. students are required to have an adviser. The Director of Graduate Studies acts as Adviser ex-officio during the first semester after which students choose one among the faculty (they can change advisers over the course of their studies).

A minimum of 30 hours is required for the master's degree to include 1) two courses in statistics; 2) one in methodology; 3) one in theory; 4) a one-hour course to learn how to use the University of Maryland computer facilities and 5) six credits of thesis

research (799). A thesis is required. Usually, this phase of the program can be completed in two years.

Ph.D. candidates must have met all the master's degree requirements. In addition, they must complete 30 credit hours beyond the M.A. courses. Specific Ph.D. requirements include: 1) A set of three courses in each of two specialties (independent reading courses do not count and the same course cannot be counted twice); 2) one additional course in Theory; 3) one additional course in Methodology; 4) one course (SOCY 701) integrating methods and theory; 5) a one- credit course to get acquainted with the computer (if not taken at the master's level); 6) 12 credit hours of dissertation research.

After completion of the coursework, doctorate students must pass two examinations qualifying them to write their dissertations in the specialties of their choice. Upon the recommendation of the appropriate faculty member, the Department Graduate Committee approves the coursework qualifying students to present the two examinations.

Facilities and Special Resources

The Sociology Department's facilities include data processing and computer capabilities, the Center on Population, Gender and Inequality, the Survey Research Center, the Center on Innovations and a Department library. The campus has excellent computer facilities and computer time is readily available to faculty and graduate students.

Financial Assistance

Financial assistance for graduate students is available through teaching and research assistantships, and for advanced students through part-time instructorships. All carry remission of tuition and fees.

Additional Information

For information and application forms, write or call:

Director of Graduate Studies
Sociology Department
University of Maryland
College Park, MD 20742-1315
(301) 405-6390

For courses, see code SOCY.

Spanish Language and Literature Program (SPAP)

Professor and Chair: Sosnowski

Professors: Nemes, Pacheco, Sarlo

Associate Professors: Aguilar-Mora (Director of Graduate Studies), Igel

Affiliate Associate Professor: Cortes

Assistant Professors: Benito-Vessels, Lavine, Naharro-Calderon, Rabasa, Sanjines, Zappala

The Department of Spanish and Portuguese offers graduate programs leading to the degrees of Master of Arts and Doctor of Philosophy in Spanish. The Department's offerings are designed to provide the required advanced training in language, literature, and linguistics for achieving professional excellence in high school and college teaching and for undertaking creative research in related fields of inquiry.

Employment statistics show that opportunities for the Department's M.A. and Ph.D. graduates have been excellent during the last 10 years. All our M.A. graduates have found employment commensurate with their academic training. Most graduates have entered teaching careers while several work in government agencies and international organizations. During the same period, all of our Ph.D. graduates who wished to undertake a career in teaching and research have obtained satisfactory appointments at colleges and universities. The important role played in this country by Hispanics and the recognition of their cultural imprint bode well for future expansion in all areas related to this particular field.

The Department participates actively in the program of the Center of Renaissance and Baroque Studies of the College of Arts and Humanities, and regularly offers courses of an interdisciplinary nature with the cooperation of faculty members of other departments.

New academic program: "DISCOVERING THE AMERICAS."

Since the fall of 1987, the Department of Spanish and Portuguese and the Latin American Studies Center have been presenting a special six-year academic program titled "Discovering The Americas", which focuses on the cultural encounter of the worlds that shaped our modern history.

The project has been divided into three two-year cycles that encompass the following areas: 1) Precolumbian cultures, 2) Africa in the Americas, and 3) Spain in the Americas. Every year the Department holds symposia and offers lectures and graduate courses given by specialists in each area. Lectures are published in the "1992 Working Papers Series."

The Department has also received a four-year award from the Rockefeller Foundation for Postdoctoral Fellowships in the Humanities. Fellows working on a variety of research projects on "The Languages and Cultures of Latin America" are distinguished scholars from major Latin American, European and North American institutions These scholars remain a semester or a year in residence and are available for consultation by faculty and graduate students. 1990-91 Fellows are Professors Oscar Teran (University of Buenos Aires), Luis H. Antezana (Universidad Mayor de San Simon, Bolivia) and Rafael Gutierrez Girardot (University of Bonn).

For detailed information, please write to the Department Chair.

Admission and Degree Information

The Department offers both a non-thesis option and the thesis option for the master's degree. A total of 30 credit hours are required for the non-thesis option with three credits in linguistics; three credits in literary theory and/or criticism; 15 credits in either Spanish or Spanish-American literature, one of which is to be considered the candidate's "major" literature; and nine credits in the other or "non-major" literature. Students must also submit a written scholarly paper in the final semester of their program which will be read and evaluated by at least two appropriate faculty members.

The requirements for the thesis option are the same as for the non-thesis option with one exception; the course requirement in the "major" literature is reduced from 15 to nine credits with six hours of thesis research credit required. All M.A. candidates take comprehensive examinations.

The doctoral degree is a research and specialized degree and it does not require a fixed number of credit hours. Before admission to candidacy, the student must demonstrate: 1) a thorough knowledge of the literary production in the chosen area (Spanish or Spanish-American Literature); 2) an in-depth knowledge of the field of specialization; 3) proficiency in a minimum of two fields of the other Hispanic literature; 4) a reading knowledge of a language other than Spanish and English, to be used as a research tool in the field of specialization; 5) one course in linguistics, such as "History of the Spanish Language"; 6) a minimum of one course in literary theory and/or criticism; 7) acquaintance with a third literature (e.g. Luso-Brazilian, French, English, etc.); and 8) a background in supporting fields to be used as research tools (e.g. history, philosophy, political science, sociology, art, etc). Students must pass both a preliminary and a comprehensive examination for the Ph.D. in addition to presenting a dissertation.

Facilities and Special Resources

The Department maintains a special research and reference library for graduate students of Spanish in honor of one of its former instructors, the late Pedro F. Entenza. Dr. Sosnowski is the editor of the journal ***Hispamerica.***

Additional Information

Financial assistance is available. For additional information please contact:

Department Chair
Department of Spanish and Portuguese
University of Maryland
College Park, MD 20742
(301) 405-6446

For courses, see code SPAP.

Special Education Program (EDSP)

Professor and Chair: Burke

Professors: Hebeler, Simms

Associate Professors: Beckman, Egel, Graham, Harris, Kohl, Leone

Assistant Professors: Cooper, Harry-Belcher, Leiber, Neubert, Speece

Instructor: Crowley

Research Associates: Anderson-Jackson, Florian, MacArthur, Malouf, McLaughlin, Pilato, Rembacki

Graduate studies in the Department of Special Education include programs leading to Master of Arts and Master of Education degrees, Advanced Graduate Specialist certificates, and Doctor of Education and Doctor of Philosophy degrees. Areas of concentration may include: Learning Disabilities; Behavior Disorders; Severely Handicapped (including Autism); Early Childhood (including Infancy); Gifted and Talented; Educationally Handicapped; and Secondary and Transition Special Education. Concentrations in Special Education Administration and Supervision and Policy Studies are also available at the doctoral level.

Historically, employment opportunities for special education graduates have been excellent. Students who graduate with a master's degree in special education may find many leadership positions in the public schools such as master teachers. Opportunities also exist in private settings in positions such as coordinators, administrators or other

specialized support staff. Doctoral degree graduates may find university faculty positions or professional staff positions in state departments of education, the federal government and in the public schools. Private agencies and organizations may also seek doctoral graduates as directors or specialized support staff.

Admission and Degree Information

The master's program requires a 3.0 undergraduate grade point average and the submission of the Miller Analogies Test or the Graduate Record Examination test scores. Admission to an A.G.S. or doctoral program requires a 3.5 grade point average in previous graduate studies and either a 3.0 undergraduate grade point average or at least a 40 percentile on the Miller Analogies Test or Graduate Record Examination.

Graduate programs are planned individually by the student and adviser to reflect the individual student's background, goals and the level of competency he or she seeks. Individual programming by students and advisers allows wide latitude of career direction within the field of special education upon completion of graduate study.

Graduate study in special education requires advanced competencies in the education of exceptional children. Students who enter the program with special education certification are required to take a minimum of 36 credit hours. Students who enter without academic preparation in education are required to take a minimum of 60 credit hours; students who enter with early childhood, elementary or secondary education certification are required to take a minimum of 45 credit hours. Upon completion of the degree, students in each of these categories may qualify for Maryland State Certification in Special Education.

Students who pursue a master's degree in special education may earn the Master of Arts degree or the Master of Education degree. Specific basic course requirements in special education are the same for either program with differentiation of thesis requirements. The student generally takes a minimum of 15 hours in special education and determines with his or her adviser the specific programs and number of credit hours required according to the student's background and career plans.

The Advanced Graduate Specialist certificate in special education is available to students who wish to take graduate courses beyond the master's level. The minimum number of graduate hours for the A.G.S. is 60. The core of the program should be made up of special education courses and other work within the College of Education or other colleges of the University as approved by the student's adviser and the special education graduate faculty.

The Ph.D. in special education is targeted primarily toward research, scholarship and educational leadership. The selection of areas of emphasis or the major concentrations listed above achieve these goals. Graduate work at the doctoral level can also be done in educational administration and supervision, and policy development and implementation for the handicapped with a specialized national focus. The Ed.D. is focused on these same areas but has an emphasis on applied research and programming. A variety of minor specializations taken outside the Department is also possible. Content coursework in the areas of administration and policy studies is developed in collaboration with other departments in the College and University.

Students pursuing the doctoral program in special education must have completed the Master of Arts degree or the Master of Education degree and may elect to work

for either the Ed.D. or Ph.D. degree. A student in the doctoral program will generally complete a minimum of 90 hours of graduate study of which 30 to 40 hours will be in the major field. Candidates must develop doctoral-level competencies in research and in any of the areas of specialization listed above that fulfill their professional goals. Students should consult the Department Statement on Graduate Programs for more information.

Facilities and Special Resources

The special education program's strengths include integrated field experiences, special education research facilities and faculty members whose diverse backgrounds enable the Department to maintain an integrated approach.

Additional Information

Prospective graduate students are requested to consult "Graduate Programs in Special Education," for additional specific information on Departmental programs, admissions procedures and financial aid. To obtain this brochure, please contact:

Chair
Special Education Program
1308 Benjamin Building
University of Maryland
College Park, MD 20742
(301) 405-6515

For courses, see code EDSP.

Speech Communication Program (SPCM)

Professor and Chair: Wolvin

Professors: Fink, Solomon, Wolvin

Associate Professors: Falcione, Freimuth, Gaines, Klumpp, McCaleb

Assistant Professor: Edgar

The Department of Speech Communication offers graduate study leading to the Master of Arts and Doctor of Philosophy degrees (The Ph.D. program is administered through the interdisciplinary program of Public Communication; see additional information under that program). Areas of study include health communication, organizational communication, political communication, interpersonal communication, cognition and persuasion, and rhetoric and public address. In addition, students will find coursework in instructional communication, intercultural communication and communication research methodology, which may be associated with the major areas.

Students with both research and pre-professional objectives enter the master's program and about one-half of them pursue doctoral study or an academic career. Others find employment after graduation in public health communication, personnel training and development, corporate communication, government policy research and speechwriting and other areas that require a highly developed knowledge of human communication. In the doctoral program, which is a research degree, over half the students pursue academic careers. Others work in public policy research, public health communication research and other professions requiring highly developed research skills.

Admission and Degree Information

Admission to the master's program is based on the student's prior academic record, GRE scores, letters of recommendation, statement of interest in graduate work and

other information relevant to the applicant's chances of successfully completing the program. Although most students will have an undergraduate degree in communication, others with an interest in studying communication are routinely admitted with additional courses assigned to remedy deficiencies.

A minimum of 30 hours is required for the master's degree. All students study both humanistic and social scientific research methods. Students who select the thesis option complete an original research project that contributes significantly to our knowledge of human communication. Those who select the non- thesis option complete a comprehensive examination and revise a research paper in their area of interest for public presentation or publication. For information on admissions and degree requirements for the Ph.D., see Public Communication.

Facilities and Special Resources

The research and laboratory facilities for studying communication in the Washington metropolitan area are unmatched by other research departments in the discipline. Students in health communication have opportunities to work with departmental research teams and participate in internship programs at the National Institutes of Health, the American Red Cross and other public health organizations. Students in organizational communication work with a broad range of voluntary, governmental, business and professional organizations that make the nation's capital their home. Students in political communication are immersed in the formal and informal institutions of American government. Students in rhetoric and public address draw upon the holdings of the Library of Congress, the National Archives and many public and private archival collections such as the Smithsonian Institution or the George Meany Center for Labor Studies.

Departmental research activity revolves around the communication research center with its library, computer and word processing resources. The campus also provides extensive mainframe and software computer resources and excellent library collections in communication. In addition the department provides the editing of journals, including two national journals, and the planning of important conferences and symposia. Students often work in conjunction with faculty members on these projects.

Financial Assistance

The department nominates outstanding applicants for competitive Graduate School fellowships. Most departmental financial aid is in the form of teaching assistantships, but research assistantships may be available in conjunction with research grants awarded to faculty members. Those applying for aid should complete their applications as early in the year as possible.

Additional Information

For additional information on graduate study in Speech Communication, contact:

Director of Graduate Studies
Department of Speech Communication
1147 Tawes
University of Maryland
College Park, MD 20742-1221
(301) 314-9573
For courses, see code SPCH.

Systems Engineering Program (ENSE)

The Systems Research Center offers graduate study leading to the Master of Science degree in Systems Engineering. Specialization is possible in automation systems, computer systems, information systems, manufacturing systems, operations research and process systems.

Admission and Degree Requirements

Admission requirements include the GRE test and three letters of recommendation.

Financial Assistance

Financial aid is available to graduate students in the form of research assistantships, teaching assistantships and fellowships. Work-study opportunities are also available.

Additional Information

Because Systems Engineering is a new program this year, not all information on faculty, courses, admission requirements, special resources and financial aid was available at the time of this catalog's printing. For more specific information, interested students should contact:

Program Director
Systems Engineering
Room 2101 A.V. Williams Building
University of Maryland
College Park, MD 20742
(301) 405-6613

For courses, contact the Systems Engineering graduate program office.

Textiles and Consumer Economics Program (TXCE)

Professor and Chair: Smith

Professors: Dardis, Spivak, Yeh

Associate Professors: Block, Brannigan, Ettenson, Paoletti, Pourdeyhimi, Wagner

Assistant Professors: Anderson, Hacklander, Mokhtari, Soberon-Ferrer, Verma, Whittington

Adjunct Assistant Professor: Basiotis

Lecturer: Morris

The Department of Textiles and Consumer Economics offers programs of study leading to the Master of Science and Doctor of Philosophy degrees with specialization fields in textiles and/or consumer economics. In the field of textiles, students may concentrate in textile science, textile economics and marketing, textile evaluation or historic textile/costume/conservation. In the field of consumer economics, students may concentrate in consumer economics, consumer policy, consumer behavior or consumption analysis.

Students with M.S. or Ph.D. degrees in Textiles and Consumer Economics have strong employment opportunities with government, industry and educational institutions.

Admission and Degree Information

There are no rigid course requirements for admission to the graduate program in Textiles and Consumer Economics. A major in home economics, consumer economics, textiles and clothing, textiles or a relevant discipline such as chemistry, economics or psychology is acceptable as background for study in this field. Preparation in the basic physical and social sciences (chemistry, mathematics, economics, psychology and sociology) is highly recommended. Necessary course prerequisites (without graduate credit) can be completed after admission to the graduate program. All applicants are required to submit scores of the Graduate Record Examination Aptitude Test.

The master's degree program offers both a thesis and non-thesis option. For the thesis option, students must complete a minimum of 24 hours of coursework, write a thesis and pass a final oral examination on the thesis. For the non-thesis option, students must complete a minimum of 30 hours of coursework, submit one scholarly paper and pass a written comprehensive final examination. Students who choose either option must present one Departmental seminar.

Students with bachelor's degrees may apply for the doctoral program, although they are encouraged to complete requirements for the M.S. degree first. Applicants holding a master's degree in an equivalent field from an accredited institution may be admitted for doctoral study. Previous graduate work will be evaluated on an individual basis, but a minimum of 18 hours of coursework beyond the master's level is required for the Ph.D. degree in addition to 12 hours of dissertation research. Qualifying examinations are administered upon completion of basic course requirements in either textiles or consumer economics. Written and oral comprehensive examinations are given upon completion of all coursework. A final oral examination is held for the student to defend the dissertation.

Facilities and Special Resources

The graduate program is multidisciplinary in nature with graduate faculty from chemistry, engineering, economics, behavioral sciences and the arts. Departmental research facilities include the historic textiles and costume collection and a number of fully equipped specialized research laboratories such as comfort research facilities, a textile conservation laboratory, several textile chemistry laboratories, a dark room for photomicroscopy, several temperature and humidity-controlled textile evaluation laboratories, a flammability testing and evaluation laboratory, a color and environmental evaluation laboratory, an image analysis laboratory and a reference resource room. In addition, the Department has a computer-aided design and a microcomputer laboratory interfaced with the University's central computing facility.

The members of our graduate faculty are active in a variety of fields, from textiles science to law. These faculty members, together with our graduate students and adjunct faculty, form a lively and intellectually stimulating community. Access to federal agencies where decisions affecting consumers are made provide graduate students with a unique opportunity to conduct consumer-related research.

Financial Assistance

Graduate teaching and/or research assistantships are offered to qualified applicants on the basis of past academic performance and experience. Work study/tuition waivers are awarded by the Financial Aid Office on the basis of need. Graduate fellowships

awarded on the basis of merit are available from the Graduate School. More than half of the full-time students in the Department hold assistantships or some form of financial aid. Part-time and summer work is often available for students who do not receive financial aid.

Additional Information

Additional information on Departmental programs, admissions, procedures and financial aid may be obtained by contacting:

Chair
Department of Textiles and Consumer Economics
Room 2100, Marie Mount Hall
University of Maryland
College Park, MD 20742
(301) 405-6657

For courses see code TXCE.

Theatre Program (THET)

Professor and Chair: Meersman

Professor: Gillespie

Associate Professor: Elam, O'Leary

Assistant Professors: Huang, Kriebs, Patterson, Patrick, Stowe, Ufema

Lecturer: Donnelly

The Department of Theatre offers graduate study leading to the degrees of Master of Arts, Master of Fine Arts and Doctor of Philosophy. Areas of emphasis in the master's program include directing, lighting design, costume design, stage design, technical theatre, theatre management, history and criticism. The master's program is designed to provide students with the opportunities to enhance and develop their practical, historical and critical knowledge of theatre in order to go on to further graduate work in Ph.D. or MFA programs.

The three-year MFA degree is designed to offer superior students advanced training and opportunities for creative activity. The program prepares the student for entrance into the professional theatre or for teaching in the creative area at college or university level. The areas of concentration are costume design, lighting design and theatre management.

The Ph.D. is a research-oriented degree. Areas of doctoral study include theatre history, theatre aesthetics, theatrical theory and theatre criticism. In conjunction with the language and literature departments of the College of Arts and Humanities, extensive study in dramatic literature is also available. Students may also combine areas where desired. The majority of students pursue academic careers as teachers and researchers while others pursue careers in the various professional areas of theatre. (For Ph.D. admission and degree information, see the Public Communication Program information).

Admission and Degree Information

In addition to the Graduate School requirements, students must provide acceptable Graduate Record Examination scores, three letters of recommendation, prior academic transcripts and a statement of interest for admission to any program. MFA applicants

must also provide a portfolio. If applicants do not have the equivalent of an undergraduate major in their field of interest, opportunities exist for them to take coursework in preparation for subsequent admission.

A minimum of 33 credit hours is required for the M.A. degree. The Department offers both the thesis and non-thesis options. All students undertaking the M.A. degree must pass a six-hour comprehensive exam on theatre history and criticism, performance and directing, and design and technical theatre. The MFA degree requires 60 credit hours and the completion of comprehensive exams and a thesis. (For Ph.D. admission and degree information, see the Public Communication Program information.)

Facilities and Special Resources

The campus is within a few miles of the John F. Kennedy Center for the Performing Arts, Arena Stage, the National Theatre, Ford's Theatre and Shakespeare Theatre at the Folger. In addition, a number of Equity and non- Equity theatres, dinner theatres and experimental theatres abound in the area.

Two of the greatest libraries in the world, the Library of Congress and the Folger Shakespeare Library are in close proximity to campus. Students also regularly make use of the Smithsonian Institution, the Federal Theatre Project Archives and more than 50 specialized libraries and institutions in the Washington metropolitan area.

The Department has use of the 1300-seat semi-thrust Tawes Fine Arts Theatre, the intimate 100-seat thrust stage, Pugliese Theatre and the 45-seat black-box Experimental Theatre.

Financial Assistance

The Department nominates outstanding applicants for competitive University fellowships. Most departmental aid is in the form of teaching assistantships. Those applying for aid should complete their applications as early in the year as possible.

Additional Information

For additional information on graduate study in Theatre at the University of Maryland, contact:

Director of Graduate Studies
Department of Theatre
1146 Tawes
University of Maryland
College Park, MD 20742
(301) 405-6676

For courses, see code THET.

Toxicology Program

The program in Toxicology is University-wide, using faculty and resources at College Park, Baltimore City and County, Eastern Shore campuses as well as the Chesapeake Biological Laboratory of the Center for Environmental and Estuarine Studies. The Program's objectives are to provide educational and professional training opportunities in fundamental and applied fields of toxicology leading to Master of Science and Doctor of Philosophy degrees. Graduates from this Program will be highly qualified to conduct research, teach and provide services to federal, state and local governments, industry, labor and the public.

Laboratory and lecture courses are offered in both basic and applied aspects of toxicology (occupational, environmental, clinical, analytical and regulatory) as well as in biochemistry, chemistry, epidemiology, pharmacology, pathology and biostatistics. Every effort is made to individualize the student's program and to encourage students to take advantage of appropriate graduate courses at all University of Maryland campuses.

Specialization at the doctoral level will be available in various areas such as aquatic and marine toxicology, neurotoxicology, occupational toxicology, environmental toxicology, regulatory toxicology, drug toxicology and others depending on the interest of the student.

For further information, please contact:

Dr. Judd Nelson
Room 0300, Symons Hall
University of Maryland
College Park, MD 20742
(301) 405-7134

For courses, see code TXCE.

Institute for Urban Studies (URBS)

Acting Director: Brower

Professors: Levin, Stone

Associate Professors: Baum, Christian, Howland, Hula

Assistant Professors: Chang, Mintz

Affiliate and Adjunct Faculty: Chen, Dupuy, Fogle, Francescato, Giloth, Laidlaw, Reich, Werlin

In July 1989, the Community Planning Program of the University of Maryland at Baltimore merged with the Institute for Urban Studies of the University of Maryland at College Park. The result is a new "Department of Urban Studies & Planning." Revisions to the graduate curricula for the Master of Arts degree in Urban Studies and the Master of Community Planning (MCP) will go into effect in Fall 1990. As these involve curriculum changes, applicants who are interested in either program should contact the Institute for more information. The M.A. degree is interdisciplinary and will serve students with a broad intellectual interest in how social sciences treat questions of urbanization and urban policy. The MCP program prepares practitioners to enter a career in for-profit, non- profit and government metropolitan organizations that relate to urban planning. The Institute's faculty specialize in: metropolitan and regional planning, public policy analysis and management, quantitative planning methods, urban design and economic development planning.

M.A. (Urban Studies) and M.C.P. graduate students (about half are part-time) have diverse personal and academic backgrounds (e.g., architecture, fine arts, English, history, business, geography, sociology, economics and political science). This diverse student body provides a rich learning environment in which many types of experiences and ideas are exchanged.

Along with core courses, students must develop concentrations through coursework in other University departments that offer instruction related to the study of urbani-

zation. Some of the departments that provide such opportunities include: Afro-American Studies, Architecture, Business and Management, Civil Engineering, Computer Science, Criminal Justice and Criminology, Economics, Education, Family and Community Development, Geography, Government and Politics, Health, Housing and Design, Journalism, Recreation, Sociology and Speech Communication. The student's concentration is developed in consultation with the Director of Graduate Studies.

Employment opportunities remain strong for Institute graduates in a highly competitive field. The Baltimore-Washington metropolitan region offers diverse employment potential in urban analysis, program management, planning and computer applications.

Admission and Degree Information

The Institute admits both experienced practitioners and recent graduates with a strong academic background. Recent graduates with an undergraduate grade point average lower than 3.25 must submit a Graduate Record Examination aptitude test score. All applicants should provide three letters of recommendation and a resume indicating their education and employment history. Experienced applicants may be admitted provisionally (subject to successful completion of initial coursework) if their undergraduate grade point average is below regular University requirements and if their employment experience indicates a high probability of success in the program. To accommodate part-time students, all required courses are offered in the late afternoon and evening.

Students must complete 37 credit hours for the M.A. degree. In consultation with an urban studies adviser, students must design a coherent concentration from courses in urban studies and related departments. Concentrations might include: metropolitan planning, urban management, urban design, community development, urban geography, public management, international development, computer applications, urban history and many other designs of a cross-disciplinary nature. An urban internship is optional, but each student must take a set of written comprehensive examinations. Both a thesis and a non-thesis option are available and require successful completion of a written comprehensive examination covering the synthesis of core course knowledge. Students are eligible to take the comprehensive examination after completing 24 credit hours, including core courses. No more than 13 credit hours at the 400-level may be applied towards the URBS M.A. degree. These requirements will alter substantially under the proposed curriculum changes. A degree in urban studies is not awarded solely on the basis of the accumulation of the minimum number of credit hours. Remedial work may be required before the degree will be awarded to a degree candidate who, in the judgement of the faculty, needs to demonstrate additional academic performance.

The Master of Community Planning degree is accredited by the American Institute of Certified Planners, the Association of Collegiate Schools of Planning and the American Planning Association. The program prepares practitioners who will be generalists with a specialization. Students receive a firm grounding in the concepts, process and practice of planning. They learn group process so they can work effectively with community groups. They are taught to understand the relationship among physical, social, political and economic aspects of planning and development, and the connection be-

tween planning and implementation. Graduation requires satisfactory completion of 58 credits.

Facilities and Special Resources

In addition to its regular faculty, the Institute draws on a number of outstanding adjunct faculty from the Baltimore-Washington metropolitan area to teach courses.

Financial Assistance

A limited number of graduate assistantships and fellowships is available and the Institute assists students in finding work-study positions, internships and part-time jobs in government agencies. USED Public Service Fellowships for under-represented groups have been available in a joint program with the School of Public Affairs.

Additional Information

Further information and the graduate bulletin of the Institute for Urban Studies may be obtained from:

Director of Graduate Studies
Institute for Urban Studies
1113 Lefrak Hall
College Park, MD 20742
(301) 405-6790

For courses, see code URBS.

Zoology Department (ZOOL)

Professor and Chair: Popper

Professors: Allan, Carter, Clark, Colombini, Gill, Highton, Levitan, Pierce

Associate Professors: Ades, Barnett, Bonar, Borgia, Goode, Higgins, Imberski, Inouye, Linder, Reaka, Small

Assistant Professors: Chao, Dietz, Olek, Palmer, Payne, Shapiro, Stephan, Wilkinson

Adjunct Professors: Kleiman, Manning, Morton, O'Brien, M. Potter, S. Smith-Gill

Adjunct Associate Professors: Hines, Kelly, Platt, Wemmer

Adjunct Assistant Professor: Braun

NOTE: Some courses in this program may require the use of animals. Please see the Statement on Animal Care and Use in the appendix and the policy statement for students under "Degree Requirements."

The Department of Zoology offers graduate study leading to the Master of Science (thesis and non-thesis) and Doctor of Philosophy degrees with specialization in the following fields: behavior, cell biology, developmental biology, ecology, estuarine and marine biology, genetics, neurobiology, physiology, systematics and evolutionary biology.

Admission and Degree Information

Admission to the Department of Zoology's graduate program requires a bachelor's degree from a recognized undergraduate institution. In addition, coursework in calculus, physics and organic chemistry is required. Able students who lack preparation in a particular area may be admitted provided that the deficiency is corrected early during graduate study. The Department requires Graduate Record Examination scores, including the subject test, which should be taken in some area of biology.

The thesis option of the master's program enables a student to engage in advanced study and to undertake a research project. The degree may also demonstrate the student's research ability and lead to the continuation of graduate work for the Ph.D. in the same or related area. The general Graduate School rules are the only requirements. All requirements for the master's degree are to be completed within a three-year period. A final oral examination on the thesis is given whenever the student has completed all other requirements for the degree.

The non-thesis master's program provides opportunity for advanced education and a terminal degree for those who are not research-oriented. All non-thesis master's students are required to complete at least 30 hours of coursework, and 18 or more of these credits must be at the 600 level or above in zoology or appropriate related fields. No fewer than 16 hours of courses must be in zoology and three of these courses should be in a single area of specialization. In addition, at least one satisfactory scholarly paper must be written in an area approved by the student's adviser. A written comprehensive examination in three areas of zoology must be passed before the degree is awarded. All requirements must be completed within a three-year period.

The Ph.D. program in zoology is a research program providing maximal opportunity for the student to evolve and develop his or her capacity for scholarship and independent work. Opportunity is provided for in-depth study in an area of specialization. A doctoral candidate must complete at least 30 credit hours of advanced coursework, including a minimum of 12 semester hours of doctoral research. A formal preliminary examination is given to all doctoral students within the first two years of enrollment in the Department. This is an oral examination that focuses primarily on determining whether the student has the proper motivation, intellectual capacity and curiosity, and educational background. The exam also determines if the student has or can develop the technical skills to successfully pursue the Ph.D. program. However, there is no formal restriction on the extent or the range of the questions asked of the candidate. The doctoral dissertation must be completed and defended usually within three, but preferably two, years after the passing of prelims.

Facilities and Special Resources

The Zoology Department's share of the Zoo-Psych Building provides adequate space for graduate instruction and research. The research laboratories are well equipped with a wide variety of scientific instrumentation. In addition, the Department has special suites for both transmission and scanning electronmicroscopy, constant temperature rooms, four sound-proof rooms (one being an anechoic chamber designed specifically for sophisticated research in ethology), photographic dark rooms, sterile transfer rooms and a histotechnology suite. Additional research opportunities are available to students through the Department's association with staff members of the National Institutes of Health, U.S. Department of Agriculture, Smithsonian Institution, National Zoo and several marine laboratories.

Although the Department maintains no library of its own, the University has a fine graduate library housing a Science and Technology Division. In addition, facilities such as the National Library of Medicine and the Department of Agriculture Library as well as the Library of Congress greatly expand the library material within relatively easy access to the Department.

Additional Information

Students are urged to communicate directly with the faculty in the area of their interest, but additional general information and a statement of particular Departmental requirements may be obtained by contacting:

Director of Graduate Studies
Department of Zoology
2231 Zoology Psychology Building
University of Maryland
College Park, MD 20742
(301) 405-6905

For courses, see code ZOOL.

Certificate Programs

Historic Preservation

Chair: Flack (History)

Committee Members: Brower (Urban Studies), Evans (History), Fogle (Architecture), Groves (Geography), Leone (Anthropology), Price (History), Sies (American Studies), Stokes (National Trust for Historic Preservation Library)

The Historic Preservation Graduate Certificate program augments the degree work of Master of Architecture, Master of Arts and Doctor of Philosophy students in the six cooperating academic units: American Studies, Anthropology, Architecture, Geography, History and Urban Studies.

Admission and Degree Information

This 24 credit interdisciplinary program is designed to help prepare students for a range of careers in the planning, management and conservation of significant cultural, natural and historical resources. Through courses, seminars and internships, students develop the basic expertise to become researchers, interpreters, curators, restorationists, archaeologists, planners, conservators and administrators in the multi-faceted field of historic preservation.

Students who seek the Certificate must meet general Graduate School requirements and normally they must have been admitted into one of the participating degree programs. Application is in the form of a letter to the Committee on Historic Preservation. In making its evaluation, the Committee will review relevant material in the Graduate School application. If appropriate, the applicant's record as a graduate student or resume generated through professional experience will be considered. Interested persons are advised to consult in advance with the chair of the Committee.

Certificate students, in conjunction with their degree programs, complete the required introductory seminar (HISP 600), a survey of preservation law, 15 credit hours of study focus courses and the final seminar (HISP 700). The total number of semester credit hours will vary according to the particular requirements of the specific degree program.

Facilities and Special Resources

The Certificate program is directly related to and substantially enhanced by the National Trust for Historic Preservation Library housed on the College Park campus since 1986. The program is further strengthened by close working relationships with

the National Park Service, the Maryland Historical Trust, the Maryland Hall of Records, the Maryland National Capital Park and Planning Commission, Historic Annapolis, Inc., Preservation Maryland, the Baltimore Commission for Historical and Architectural Preservation, and the Montgomery and Prince George's County Historic Preservation Commissions. Practical experience can be gained through ongoing summer projects at the Chalfonte Hotel in Cape May, New Jersey and at Kiplin Hall in North Yorkshire, England.

Financial Assistance

There are possibilities of paid internships with the National Park Service and the Historic American Building Survey/History American Engineering Record. Certificate students may be teaching assistants in related academic units. Also, students in the Certificate program are specially eligible for the annual Margaret Cook Award, a cash prize endowed by Prince George's Heritage, Inc. and the Prince George's County Historical and Cultural Trust.

Additional Information

Complete descriptions of academic offerings and requirements may be obtained from the Committee on Historic Preservation.

For courses, see code HISP.

Gerontology Certificate

The Graduate Gerontology Certificate program trains students at the master's and doctoral levels as specialists in aging and adult development. A student is eligible after having been accepted into a master's or doctoral program at the University of Maryland or having already earned a master's or doctoral degree. The master's student must complete 18 credit hours and the doctoral student must complete 21 credit hours for the program. Nine of these hours are selected from core areas including Physical Bases, Psychological Bases and Social Bases of aging. Three credits are taken to satisfy the internship requirement and the remaining credits may be chosen from either the core or complementary courses in gerontology.

Course Descriptions

AASP – Afro-American Studies

AASP 400 Directed Readings in Afro-American Studies (3)
The readings will be directed by the Director of Afro-American Studies. Topics to be covered: the topics will be chosen by the director to meet the needs and interests of individual students.

AASP 402 Classic Readings in Afro-American Studies (3)
Classic readings of the social, economic and political status of blacks and other minorities in the United States and the Americas.

AASP 410 Contemporary African Ideologies (3)
Analysis of contemporary African ideologies. Emphasis on philosophies of Nyerere, Nkrumah, Senghor, Sekou Toure, Kaunda, Cabral, et al. Discussion of the role of African ideologies on modernization and social change.

AASP 411 Black Resistance Movements (3)
A comparative study of the black resistance movements in Africa and America; analysis of their interrelationships as well as their impact on contemporary pan-Africanism.

AASP 441 Science, Technology, and the Black Community (3)
Prerequisite: AASP 100 or AASP 202 or HIST 255 or permission of department. Scientific knowledge and skills in solving technological and social problems, particularly those faced by the black community. Examines the evolution and development of African and Afro-American contributions to science. Surveys the impact of technological changes on minority communities.

AASP 443 Blacks and the Law (3)
Prerequisite: AASP 100 or AASP 202 or HIST 255 or permission of department. The relationship between black Americans and the law, particularly criminal law, criminal institutions and the criminal justice system. Examines historical changes in the legal status of blacks and changes in the causes of racial disparities in criminal involvement and punishments.

AASP 497 Policy Seminar in Afro-American Studies (3)
Prerequisite: AASP 301 or permission of department. Application of public policy analysis to important social problems and policy issues affecting black Americans. Policy research and analysis procedures through an in-depth study of a critical, national black policy issue.

AASP 498 Special Topics in Black Culture (3)
Prerequisite: AASP 100 or AASP 202. Repeatable to 6 credits if content differs. Advanced study of the cultural and historical antecedents of contemporary African and Afro-American society. Emphasis on the social, political, economic and behavioral factors affecting blacks and their communities. Topics vary.

AASP 499 Advanced Topics in Public Policy and the Black Community (3)
Prerequisite: AASP 301 or permission of department. Repeatable to 6 credits if content differs. Examination of specific areas of policy development and evaluation in black and other communities. Application of advanced tools of policy analysis, especially quantitative, statistical and micro-economic analysis.

AEED – Agricultural and Extension Education

AEED 464 Rural Life in Modern Society (3)
The historical and current nature of rural and agricultural areas and communities in the complex structure and culture of U.S. society. Basic structural, cultural, and functional concepts for analyses and contrasts of societies and the organizations and social systems within them.

AEED 466 Rural Poverty in an Affluent Society (3)
Factors giving rise to conditions of rural poverty. Problems faced by the rural poor. Programs designed to alleviate rural poverty.

AEED 488 Critique in Rural Education (1)
Current problems and trends in rural education.

AEED 489 Field Experience (1-4)
Prerequisite: permission of department. Repeatable to 4 credits. Planned field experience for both major and non-major students.

AEED 499 Special Problems (1-3)

AEED 606 Program Planning and Evaluation in Agricultural Education (2-3)
Second semester. Analysis of community agricultural education needs, selection and organization of course content, criteria and procedures for evaluating programs.

AEED 626 Program Development in Adult and Continuing Education (3)
Concepts in program planning and development. Study and analysis of program design and implementation in adult and continuing education.

AEED 627 Program Evaluation in Adult and Continuing Education (3)
Prerequisite: AEED 626 or permission of department. An analysis of program evaluation concepts as they relate specifically to adult continuing education. Program evaluation concepts, issues and problems with emphasis on the use of evaluation procedures.

AEED 630 Teaching-Learning in Adult and Continuing Education (3)
The teaching/learning process in adult continuing education. Instructional techniques and methodologies appropriate for adults. The curriculum development process. Issues and priorities in adult continuing education.

AEED 632 International Extension/Adult Education (3)
The state of extension/adult education in other countries. The social context of extension/adult education in selected countries. Analysis of existing extension/adult education programs and the contributions of these systems to the field.

AEED 661 Rural Community Analysis (3)
Communities as social systems composed of organizations which interact in a system of cultural institutions, norms, and values. Functional and structural linkages between organizations within as well as outside the community; rural vs. urban similarities and differences; and the role of the social processes such as competition, cooperation and conflict in the context of community power and leadership structure.

AEED 691 Research Methods in Adult and Continuing Education (3)
The scientific method, problem identification, survey of research literature, preparing research plans, design of studies, experimentation, analysis of data and thesis writing.

AEED 699 Special Problems (1-3)

AEED 789 Special Topics (1-3)
Repeatable to 9 credits if content differs.

AEED 798 Seminar in Rural Education (1-3)
Repeatable to 8 credits. Problems in the organization, administration, and supervision of the several agencies of rural and/or vocational education.

AEED 799 Master's Thesis Research (1-6)

AEED 888 Apprenticeship in Education (1-8)
Prerequisites: experience, a master's degree, and at least six semester hours in education at the University of Maryland. Apprenticeships in the major area of study are available to selected students whose application for an apprenticeship has been approved by the education faculty.

Each apprentice is assigned to work for at least a semester full-time or the equivalent with an appropriate agency. The sponsor of the apprentice maintains a close working relationship with the apprentice and the other persons involved.

AEED 889 Internship in Education (3-8)
Internships in the major area of study for experienced students who are assigned to an appropriate school system, educational institution, or agency in a situation different than that in which the student is regularly employed.

AEED 899 Doctoral Dissertation Research (1-8)

AGRI – Agriculture

AGRI 489 Special Topics in Agriculture (1-4)
Credit according to time scheduled and organization of the course. A lecture series organized to study in depth a selected phase of agriculture not normally associated with one of the existing programs.

AGRO – Agronomy

AGRO 401 Pest Management Strategies for Turfgrass (3)
Prerequisite: AGRO 305. Interdisciplinary view or week, disease, and insect management from an agronomy perspective. Plant responses to pest invasion, diagnosis of pest-related disorders, and principles of weed, disease and insect suppression through cultural, biological and chemical means are discussed.

AGRO 402 Sports Turf Management (3)
Two hours of lecture and three hours of laboratory per week. *Prerequisite: AGRO 305 and AGRO 401.* Sports turf management, including design, construction, soil modification, soil cultural techniques, pesticide use, fertilization, and specialized equipment.

AGRO 403 Crop Breeding (3)
Prerequisite: BOTN 414 or ZOOL 213. Principles and methods of breeding annual self and cross-pollinated plant and perennial forage species.

AGRO 406 Forage Crops (3)
Prerequisite: BIOL 105. Recommended: BIOL 106. World grasslands and their influence on early civilizations; current impact on human food supply; role of forages in soil conservation and a sustainable agriculture. Production and management requirements of major grass and legume species for silage and pasture for livestock feed. Cultivar development; certified seed production and distribution.

AGRO 407 Cereal and Oil Crops (3)
Pre- or corequisites: BIOL 105 and AGRO 101. A study of principles and practices of corn, small grains, rice, millets, sorghums, and soybeans and other oil seed crops. A study of seed production, processing, distribution and federal and state seed control programs of corn, small grains and soybeans.

AGRO 410 Commercial Turf Maintenance and Production (3)
Prerequisite: AGRO 305 and AGRO 401. Commercial lawn care industry, sod production and turfgrass seed production. Fertilizer, renovation programs, and weed and insect control programs used in professional lawn care. Environmental effects of lawn care programs.

AGRO 411 Principles of Soil Fertility (3)
Soil factors affecting plant growth and quality with emphasis on the bio-availability of mineral nutrients. The management of soil systems to enhance plant growth by means of crop rotations, microbial activities, and use of organic and inorganic amendments

AGRO 413 Soil and Water Conservation and Managment (3)
Prerequisite: AGRO 302. Importance and causes of soil erosion, methods of soil erosion control. Effects of conservation practices on soil physical properities and the plant root environment. Irrigation and drainage as related to water use and conservation.

AGRO 414 Soil Morphology, Genesis and Classification (4)
Three hours of lecture and three hours of laboratory per week. *Prerequisite: AGRO 302.* Processes and factors of soil genesis. Taxonomy of soils of the world by U.S. System. Soil morphological characteristics, composition, classification, survey and field trips to examine and describe soils.

AGRO 415 Soil Survey and Land Use (3)
Two hours of lecture and three hours of laboratory per week. *Prerequisite: AGRO 302.* Evaluation of soils in the uses of land and the environmental implications of soil utilization. Interpretation of soil information and soil surveys as applied to both agricultural and non-agricultural problems. Incorporation of soil data into legislation, environmental standards and land use plans.

AGRO 417 Soil Physics (3)
Two hours of lecture and three hours of laboratory per week. *Prerequisites: AGRO 302 and a course in physics; or permission of department.* A study of physical properties of soils with special emphasis on relationship to soil productivity.

AGRO 421 Soil Chemistry (4)
Three hours of lecture and three hours of laboratory per week. *Prerequisite: AGRO 302.* The chemistry and composition of mineral and organic colloids in soils, including ion exchange, oxidation-reduction, acidity, surface charge, and solution chemistry. Lectures and readings pertain to plant nutrition, waste disposal, and groundwater quality.

AGRO 422 Soil Microbiology (3)
Prerequisite: AGRO 302, CHEM 104 or permission of department. Relationship of soil microorganisms to the soils' physical and chemical properties. Nirtogen fixation, mycorrhiza-plant interactions and microbially mediated cycling.

AGRO 423 Soil-Water Pollution (3)
Prerequisites: AGRO 302 and CHEM 104 or permission of department. Reaction and fate of pesticides, agricultural fertilizers, industrial and animal wastes in soil and water with emphasis on their relation to the environment.

AGRO 440 Crop, Soils, and Civilization (3)
Role and importance of crop and soil resources in the development of human civilization. History of crops and soils as they relate to the persistence of ancient and modern cultures.

AGRO 441 Sustainable Agriculture (3)
Environmental, social and economic needs for alternatives to the conventional, high-imput farming systems which currently predominate in industrial countries. Strategies and practices that minimize the use of non-renewable resources.

AGRO 444 Remote Sensing of Agriculture and Natural Resources (3)
Interaction of electromagnetic radiation. Remote sensing technology to agriculture and natural resource inventory, monitoring and management and related environmental concerns.

AGRO 451 Crop Culture and Development (3)
Pre or corequisite: BOTN 441. Application of basic plant physiology to crop production. Photosynthesis, respiration, mineral nutrition, water and temperature stress, and post-harvest physiology.

AGRO 453 Weed Science (3)
Two hours of lecture and three hours of laboratory per week. Weed identification, ecology, and control (cultural, mechanical, biological, and chemical methods).

AGRO 454 Air and Soil Pollution Effects on Crops (3)
Effects of air pollutants such as ozone, sulfur dioxide, acid rain, etc., and soil pollutants such as toxic metals, pesticides, on the growth, productivity and quality of crops.

AGRO 483 Plant Breeding Laboratory (2)
Prerequisites: AGRO 403 and permission of department. Current plant breeding research being conducted at The University of Maryland and USDA at Beltsville. Discussion with plant breeders about pollination techniques, breeding methods, and program achievements and goals. Field trips to selected USDA laboratories.

AGRO 499 Special Problems in Agronomy (1-3)
Prerequisites: AGRO 302, AGRO 406, AGRO 407 or permission of department. A detailed study, including a written report of an important problem in agronomy.

AGRO 601 Advanced Crop Breeding I (2)
Prerequisite: AGRO 403 or equivalent. Genetic and cytogenetic theories as related to plant breeding including interspecific and intergeneric hybridization, polyploidy, and sterility mechanisms.

AGRO 602 Advanced Crop Breeding II (2)
Prerequisites: AGRO 601 and a graduate statistics course. Quantitative inheritance in plant breeding including genetic constitution of a population, continuous variation, estimation of genetic variances, heterosis and inbreeding, heritability, and population movement.

AGRO 608 Research Methods (1-4)
Prerequisite: permission of department. Repeatable to 4 credits. Development of research viewpoint by detailed study and report on crop and soil research of the Maryland Agriculture Experiment Station or review and discussion of literature on specific agricultural problems or new research techniques.

AGRO 711 Advanced Plant-Soil Relationship (2)
Prerequisite: AGRO 411. Integration of the biological, physical, and chemical aspects of plant growth in soils.

AGRO 722 Advanced Soil Chemistry (3)
Prerequisites: AGRO 202 and permission of both department and instructor. A continuation of AGRO 421 with emphasis on soil chemistry of minor elements necessary for plant growth.

AGRO 789 Advances in Agronomy Research (1-4)
Prerequisite: permission of department. Repeatable to 4 credits if content differs. A study of recent advances in agronomy research.

AGRO 798 Agronomy Seminar (1)
Total credit toward Master of Science degree, 2; toward Ph.D. degree, 6. Prerequisite: permission of both department and instructor. First and second semester.

AGRO 799 Master's Thesis Research (1-6)

AGRO 802 Breeding For Resistance to Plant Pests (3)
Prerequisites: ENTM 252, BOTN 221, AGRO 403 or permission of department. Spring semester, alternate years. Development of breeding techniques for selecting and utilizing resistance to insects and diseases in crop plants and the effect of resistance on the interrelationships of host and pest.

AGRO 804 Design and Analysis of Crop Research (3)
Prerequisite: BIOM 401. Field plot technique, application of statistical analysis to agronomic data, and preparation of the research project.

AGRO 805 Factors Affecting Crop Yields (2)
Prerequisites: BOTN 441 or BOTN 641; plus advanced training in plant sciences. Major emphasis will be on physiological processes affecting yield and productivity of major food fiber and in-

dustrial crops of the world. Topics such as photosynthesis, respiration, photorespiration, nitrogen metabolism will be related to crop growth as affected by management decisions. Topics of discussion will also include growth analysis and the use of computer modeling of crop growth by plant scientists.

AGRO 806 Herbicide Chemistry and Physiology (2)
Prerequisites: AGRO 453; and CHEM 104. The importance of chemical structure in relation to biologically significant reactions will be emphasized in more than 10 different herbicide groups. Recent advances in herbicidal metabolism, translocation, and mode of action will be reviewed. Absorption, decomposition and movement in the soil will also be studied.

AGRO 821 Advanced Methods of Soil Investigation (3)
Prerequisites: AGRO 302; permission of both department and instructor. First semester, alternate years. An advanced study of the theory of the chemical methods of soil investigation with emphasis on problems involving application of physical chemistry.

AGRO 831 Soil Mineralogy (4)
Soil minerals, with emphasis on clay minerals, are studied from the viewpoint of soil genesis and physical chemistry. Mineralogical analyses by x-ray and chemical techniques.

AGRO 832 Advanced Soil Physics (3)
Prerequisites: AGRO 417; and permission of both department and instructor. An advanced study of physical properties of soils.

AGRO 899 Doctoral Dissertation Research (1-8)

AMST – American Studies

AMST 418 Cultural Themes in America (3)
Repeatable to 6 credits if content differs. Examination of structure and development of American culture through themes such as "growing up American", "culture and mental disorders","race", "ethnicity", "regionalism", "landscape", "humor".

AMST 426 Culture and the Arts in America (3)
Analysis of development of American cultural institutions and artifacts.

AMST 428 American Cultural Eras (3)
Repeatable to 6 credits if content differs. Investigation of a decade, period, or generation as a case study in significant social change within an American context. Case studies include "Antebellum America, 1840-1860", "American culture in the Great Depression".

AMST 429 Perspectives on Popular Culture (3)
Repeatable to 6 credits if content differs. Topics in popular culture studies, including the examination of particular genres, themes, and issues.

AMST 432 Literature and American Society (3)
Prerequisite: prior course in AMST, SOCY, American literature, or American history. Examination of the relationship between literature and society: including literature as cultural communication and the institutional framework governing its production, distribution, conservation and evaluation.

AMST 450 Seminar in American Studies (3)
Prerequisite: permission of department. Developments in theories and methods of American studies scholarship, with emphasis upon interaction between the humanities and the social sciences in the process of cultural analysis and evaluation.

AMST 498 Special Topics in American Studies (3)
Prerequisite: a course in American history, literature, or government; or permission of department. Repeatable to 6 credits if content differs. Topics of special interest.

AMST 618 Introductory Seminar in American Studies (3)

AMST 628 Seminar in American Studies (3)

AMST 629 Seminar in American Studies (3)

AMST 638 Orientation Seminar: Material Aspects of American Civilization (3)
Class meets at the Smithsonian.

AMST 639 Reading Course in Selected Aspects of American Civilization (3)
Class meets at the Smithsonian.

AMST 698 Directed Readings in American Studies (3)
Repeatable to 6 credits if content differs. This course is designed to provide students with the opportunity to pursue independent, interdisciplinary research and reading in specific aspects of American culture under the supervision of a faculty member.

AMST 799 Master's Thesis Research (1-6)

AMST 899 Doctoral Dissertation Research (1-8)

ANSC – Animal Science

Some of these courses may require the use of animals. See the statement on Animal Care and Use in the appendix and the policy statement for students under degree requirements.

ANSC 401 Fundamentals of Nutrition (3)
Prerequisite: CHEM 104 and ANSC 212. Recommended: BCHM 261. A study of the fundamental role of all nutrients in the body including their digestion, absorption and metabolism. Dietary requirements and nutritional deficiency syndromes of laboratory and farm animals and humans.

ANSC 402 Applied Animal Nutrition (3)
Two hours of lecture and two hours of laboratory per week. *Prerequisite: MATH 115 and ANSC 401.* A critical study of those factors which influence the nutritional requirements of ruminants, swine and poultry. Practical feeding methods and procedures used in formulation of economically efficient rations will be presented.

ANSC 406 Environmental Physiology (3)
Prerequisite: anatomy and physiology. The specific anatomical and physiological modifications employed by animals adapted to certain stressful environments will be considered. Particular emphasis will be placed on the problems of temperature regulation and water balance. Specific areas for consideration will include: animals in cold (including hibernation), animals in dry heat, diving animals and animals in high altitudes.

ANSC 412 Introduction to Diseases of Animals (3)
Two lectures and one laboratory period per week. *Prequisite: MICB 200 and BIOL 105.* This course gives basic instruction in the nature of disease: including causation, immunity, methods of diagnosis, economic importance, public health aspects and prevention and control of the common diseases of sheep, cattle, swine, horses and poultry.

ANSC 413 Laboratory Animal Management (3)
A comprehensive course in care and management of laboratory animals. Emphasis will be placed on physiology, anatomy and special uses for the different species. Disease prevention and regulations for maintaining animal colonies will be covered. Field trips will be required.

ANSC 415 Parasitic Diseases of Domestic Animals (3)
Two hours of lecture and two hours of laboratory per week. *Prerequisite: ANSC 412 or equivalent.* A study of parasitic diseases resulting from protozoan and helminth infection and arthropod infestation. Emphasis on parasites of veterinary importance: their identification; life cycles, pathological effects and control by management.

ANSC 421 Swine Production (3)
Two hours of lecture and four hours of laboratory per week. *Prerequisite: ANSC 101; ANSC 221; and ANSC 203 or ANSC 401.* A study of swine production systems including the principles of animal science for the efficient and economical management of swine breeding, feeding, reproduction and marketing.

ANSC 422 Meats (3)
Two hours of lecture and three hours of laboratory per week. *Prerequisite: ANSC 221.* A course designed to give the basic facts about meat as a food and the factors influencing acceptability, marketing, and quality of fresh meats. It includes comparisons of characteristics of live animals with their carcasses, grading and evaluating carcasses as well as wholesale cuts, and the distribution and merchandising of the nation's meat supply. Laboratory periods are conducted in packing houses, meat distribution centers, retail outlets and University Meats Laboratory.

ANSC 423 Beef Production (3)
Two hours of lecture and three hours of laboratory per week. Prerequisite: ANSC 221 and ANSC 203 or ANSC 401. Application of various phases of animal science to the management and production of beef cattle.

ANSC 424 Sheep Production (3)
Two hours of lecture and three hours of laboratory per week. *Prerequisite: ANSC 221 and ANSC 203 or ANSC 401.* A study of sheep production systems including the principles of animal science for the efficient and economical management of sheep breeding, feeding, reproduction and marketing.

ANSC 430 Topics in Equine Science (4)
Three hours of lecture and two hours of discussion/recitation per week. *Prerequisites: ANSC 211; ANSC 212 and ANSC 230. Preor corequisite: ANSC 401.* Specific problems of importance to the equine industry, including such areas as nutrition, physiology, anatomy, genetics and pathology.

ANSC 431 Horse Production (2)
One hour of lecture and two hours of laboratory per week. *Prerequisite: ANSC 101; ANSC 211; ANSC 212; ANSC 230 and permission of department.* Laboratory and assigned project to be performed at University of Maryland Horse Farm, Ellicott City, Md. Field trips. Application of equine science principles to the management and production of horses.

ANSC 432 Breeding Farm Management (2)
One hour of lecture and two hours of laboratory per week. *Prerequisite: ANSC 211; ANSC 212; ANSC 230 and permission of department.* Animal equine science principles in the management of equine breeding establishments. Field trips.

ANSC 443 Physiology and Biochemistry of Lactation (3)
Prerequisite: ANSC 212 or equivalent; and BCHM 261 or BCHM 461. The physiology and biochemistry of milk production in domestic animals, particularly cattle. Mammary gland development and maintenance from the embryo to the fully developed lactating gland. Abnormalities of the mammary gland.

ANSC 444 Analysis of Dairy Production Systems (3)
Prerequisites: AREC 306 and ANSC 203. The business aspects of dairy farming including an evaluation of the costs and returns associated with each segment. The economic impact of pertinent management decisions is studied. Recent developments in animal nutrition and genetics, agricultural economics, agricultural engineering, and agronomic practices are discussed as they apply to management of a dairy herd.

ANSC 446 Physiology of Mammalian Reproduction (3)
Prerequisite: ZOOL 422 or ANSC 212. Anatomy and physiology of reproductive processes in domesticated and wild mammals.

ANSC 447 Physiology of Mammalian Reproduction Laboratory (1)
Three hours of laboratory per week. *Pre- or corequisite: ANSC 446.* Animal handling, artificial insemination procedures and analytical techniques useful in animal management and reproductive research.

ANSC 452 Avian Physiology (2)
Two two-hour lecture/laboratory/demonstration periods per week. *Prequisite: a basic course in animal anatomy or physiology.* The digestive, immune, excretory, respiratory, muscle, circulatory, endocrine and nervous systems of avian species. Laboratory exercises include use of anesthetics, suturing techniques, use of a polygraph and instrumentation for analyzing blood, urine, liver, kidney and brain tissue.

ANSC 462 Physiology of Hatchability (1)
Two lectures and one laboratory period per week. *Prequisite: BIOL 105.* The physiology of embryonic development as related to principles of hatchability and problems of incubation encountered in the hatchery industry are discussed.

ANSC 487 Special Topics in Animal Science (1)
Prerequisite: permission of department. This course is designed primarily for teachers of vocational agriculture and extension service personnel. One primary topic to be selected mutually by the instructor and students will be presented each session.

ANSC 601 Advanced Ruminant Nutrition (2)
One hour of lecture and three hours of laboratory per week. *Prerequisite: permission of instructor.* Physiological, microbiological and biochemical aspects of the nutrition of ruminants as compared to other animals.

ANSC 603 Mineral Metabolism (3)
Prerequisites: BCHM 461 and BCHM 462. The role of minerals in metabolism of animals and man. Topics to be covered include the role of minerals in energy metabolism, bone structure, electrolyte balance, and as catalysts.

ANSC 604 Vitamin Nutrition (3)
Two hours of lecture and two hours of laboratory per week. *Prerequisite: ANSC 401 and BCHM 461.* Advanced study of the fundamental role of vitamins and vitamin-like cofactors in nutrition including chemical properties, absorption, metabolism, excretion and deficiency syndromes. A critical study of the biochemical basis of vitamin function, interrelationship of vitamins with other substances and of certain laboratory techniques.

ANSC 610 Electron Microscopy (4)
Two hours of lecture and four hours of laboratory per week. *Prerequisite: permission of both department and instructor.* Theory of electron microscopy, electron optics, specimen preparation and techniques, operation of electron photography, interpretation of electron images, related instruments and techniques.

ANSC 612 Energy Nutrition (2)
One lecture and two hours of laboratory per week. *Prequisite: ANSC 401 or NUSC 450, and BCHM 461.* Basic concepts of animal energetics with quantitative descriptions of energy requirements and utilization.

ANSC 614 Proteins (2)
One hour of lecture and two hours of laboratory per week. *Prerequisite: ANSC 401 and BCHM 461.* Advanced study of the roles of amino acids in nutrition and metabolism. Protein digestion, absorption, anabolism, catabolism and amino acid balance.

ANSC 626 Advanced Animal Breeding (3)
Prerequisite: [ANSC 327; and MATH 400; and BIOM 603] or permission of both department and instructor. Application of linear models to genetic evaluation of domestic livestock. Introduction to estimation of components of variance in mixed linear models.

ANSC 643 Research Methods (3)
One lecture and two laboratory periods per week. *Prerequisite: permission of department and instructor.* The application of biochemical, physio-chemical and statistical methods to problems in biological research.

ANSC 660 Poultry Literature (1-4)
Readings on individual topics are assigned. Written reports required. Methods of analysis and presentation of scientific material are discussed.

ANSC 661 Physiology of Reproduction (3)
Reproductive endocrinology of vertebrate species with attention to function of the male and female reproductive systems, neuroendocrine regulation of reproduction and cellular mechanisms.

ANSC 663 Advanced Nutrition Laboratory (3)
One hour of lecture and six hours of laboratory per week. *Prerequisite: ANSC/NUSC 401; and either BCHM 462 or NUSC 670. Also offered as NUSC 663.* Basic instrumentation and techniques desired for advanced nutritional research. The effect of various nutritional parameters upon intermediary metabolism, enzyme kinetics, endocrinology, and nutrient absorption in laboratory animals.

ANSC 677 Advanced Animal Adaptations to the Environment (2)
Prerequisite: ANSC 406 or permission of instructor. A detailed consideration of certain anatomical and physiological modifications employed by mammals adapted to cold, dry heat or altitude. Each student will submit for discussion a library paper concerning a specific adaptation to an environmental stress.

ANSC 686 Veterinary Bacteriology and Mycology (3)
Prerequisite: ANSC 412. The characteristics and role of pathogenic bacteria and fungi in diseases of domestic animals with emphasis upon their pathogenic properties, pathogenesis and types of disease, epizootiology, modes of transmission and prophylaxis.

ANSC 687 Veterinary Virology (3)
Prerequisite: MICB 460. A detailed study of viral and rickettsial diseases of domestic and laboratory animals. Emphasis on viruses of veterinary importance along with techniques for their propagation, characterization and identification.

ANSC 698 Seminar (1)
Students are required to prepare papers based upon current scientific publications relating to animal science, or upon their research work, for presentation before and discussion by the class; (1) recent advances; (2) nutrition; (3) physiology; (4) biochemistry.

ANSC 699 Special Problems in Animal Science (1-2)
Work assigned in proportion to amount of credit. *Prerequisite: approval of staff. Problems will be assigned which relate specifically to the character of work the student is pursuing.*

ANSC 799 Master's Thesis Research (1-6)

ANSC 899 Doctoral Dissertation Research (1-8)

ANTH – Anthropology

ANTH 401 Cultural Anthropology: Principles and Processes (3)
Prerequisites: ANTH 101, ANTH 102, or ANTH 221. An examination of the nature of human culture and its processes, both historical and functional. The approach will be topical and theoretical rather than descriptive.

ANTH 402 Cultural Anthropology: World Ethnography (3)
Prerequisites: ANTH 101, ANTH 102, or ANTH 221. A descriptive survey of the culture areas of the world through an examination of the ways of selected representative societies.

ANTH 412 Peoples and Cultures of Oceania (3)
A survey of the cultures of Polynesia, Micronesia, Melanesia and Australia. Theoretical and cultural-historical problems will be emphasized.

ANTH 414 Ethnology of Africa (3)
Prerequisites: ANTH 101 and ANTH 102. The native peoples and cultures of Africa and their historical relationships, with emphasis on that portion of the continent south of the Sahara.

ANTH 417 Peoples and Cultures of the Far East (3)
A survey of the major sociopolitical systems of China, Korea and Japan. Major anthropological questions will be dealt with in presenting this material.

ANTH 423 Ethnology of the Southwest (3)
Prerequisites: ANTH 101 and ANTH 102. Culture history, economic and social institutions, religion, and mythology of the Indians of the southwest United States.

ANTH 424 Ethnology of North America (3)
Prerequisites: ANTH 101 and ANTH 102. The native people and cultures of North America north of Mexico and their historical relationships, including the effects of contact with European-derived populations.

ANTH 426 Ethnology of Middle America (3)
Prerequisites: ANTH 101 and ANTH 102. Cultural background and modern social, economic and religious life of Indian and Mesitzo groups in Mexico and central America; processes of acculturation and currents in cultural development.

ANTH 431 Social Organization of Primitive Peoples (3)
Prerequisites: ANTH 101 and ANTH 102. A comparative survey of the structures of non-literate and folk societies, covering both general principles and special regional developments.

ANTH 434 Religion of Primitive Peoples (3)
Prerequisites: ANTH 101 and ANTH 102. A survey of the religious systems of primitive and folk societies, with emphasis on the relation of religion to other aspects of culture.

ANTH 436 Primitive Technology and Economy (3)
A survey of technology, food economy and general economic processes in non-industrial societies.

ANTH 437 Politics and Government in Primitive Society (3)
A combined survey of politics in human societies and of important anthropological theories concerning this aspect of society.

ANTH 441 Archaeology of the Old World (3)
Prerequisite: ANTH 101 or ANTH 241. A survey of the archaeological materials of Europe, Asia and Africa, with emphasis on chronological and regional interrelationships.

ANTH 451 Archaeology of the New World (3)
Prerequisite: ANTH 101 or ANTH 241. A survey of the archaeological materials of North and South America with emphasis on chronological and regional interrelationships.

ANTH 461 Human Osteology Laboratory (3)
Prerequisite: ANTH 101. A laboratory study of the human skeleton, its morphology, measurement, and anatomic relationships.

ANTH 462 Primate Anatomy Laboratory (3)
Prerequisite: ANTH 101. The gross anatomy of non-human primates. Laboratory dissection of various primate cadavers under supervision. Occasional lectures.

ANTH 463 Primate Studies (3)
Prerequisite: ANTH 101. A combination lecture and laboratory examination of non-human primates. Major studies of various types that have been undertaken in the laboratory and in the field.

ANTH 465 Human Growth and Constitution (3)
Prerequisite: ANTH 101. A laboratory study of the growth, development and age changes in the human body from conception through old age, including gross photographic, radiographic, and microscopic study of growth and variation.

ANTH 466 Forensic Anthropology Laboratory (3)
Prerequisite: ANTH 461 or permission of department. A laboratory study of the methods used to identify human remains by anthropological techniques and discussion of the role of the anthropologist in medico-legal investigation.

ANTH 467 Human Population Biology Laboratory (3)
Prerequisite: ANTH 101. A laboratory study of human population genetics, dynamics and variation, including anthropological seriology, biochemistry, dermatoglyphics and hair microscopy.

ANTH 496 Field Methods in Archaeology (8)
Formerly ANTH 499. Field training in the techniques of archaeological survey and excavation.

ANTH 498 Field Methods in Ethnology (1-6)
Field training in the collection and recording of ethnological data.

ANTH 601 Applied Anthropology (3)
History and theory of applied anthropology. The relationship between applied anthropology and other major subfields of the profession; the interdisciplinary and public context of application; problems of significance and utility in applied work.

ANTH 605 Theory of Cultural Anthropology (3)
History and current trends of cultural anthropological theory, as a basic orientation for graduate studies and research.

ANTH 606 Methods of Cultural Analysis I (3)
Objectives of cultural analysis and their relationship to policy and decision making. An introduction to problem formulation, qualitative and quantative research design, and the conduct of research; problems of reliability and validity in social research.

ANTH 607 Methods of Cultural Analysis II (3)
Advanced preparation in the analysis and review of social research. Case studies of the uses of cultural analysis in applied contexts (i.e., social indicators, evaluation, impact assessment, forecasting).

ANTH 611 Management and Cultural Process (3)
Basic principles of managing cultural and human resources, decision-making in public and private contexts. The diversity and types of cultural resources (archeological, historical, folk and sociocultural), and their recognition and value in contemporary society; introduction to the identification, protection and professional management of cultural resources.

ANTH 620 Strategies for Cultural Understanding (3)
The political, scientific, bureaucratic, and ideological background to decision making in the public and private sectors.

ANTH 621 Cultural Ecology (3)
Prerequisite: permission of instructor. An examination of the nature of the interrelationships between human cultures and the natural environmentals in which they exist.

ANTH 630 Quantitative Approaches to Applied Anthropology (3)
Introduction to variety of statistical techniques applied to problems in policy and decision making. Practical experience in computer applications for problems in cultural analysis and management. The use of existing statistical data sources.

ANTH 641 Method and Theory in Archaeology (3)
Prerequisite: permission of instructor. An examination of the principles and purposes involved in the gathering and interpretation of archaeological data.

ANTH 681 Processes of Culture Change (3)
Change in culture due to contact, diffusion, innovation, fusion, integration, and cultural evolution.

ANTH 688 Current Developments in Anthropology (3)
Repeatable to 9 credits if content differs. Detailed investigation of a current problem or research technique, the topic to be chosen in accordance with faculty interests and student needs.

ANTH 689 Special Problems in Anthropology (1-6)

ANTH 696 Field Methods in Archaeology (8)
Formerly ANTH 699. Field training in the techniques of archaeological survey and excavation.

ANTH 698 Advanced Field Training in Ethnology (1-6)
Offered in the summer session only.

ANTH 701 Internship Preparation (3)
Preparation for internship includes practicum training in development, presentation and evaluation of position papers, proposals and work plans; literature search and use of secondary data sources in decision making affecting cultural analysis and management. Ethics and professional development for work in non-academic settings.

ANTH 705 Internship (6-12)
Prerequisite: ANTH 701. Problem-oriented internship with an appropriate public agency or private institution under the direction of a faculty and agency supervisor.

ANTH 712 Internship Analysis (3)
Prerequisite: ANTH 705. The preparation and presentation of internship reports; development of skills in report writing and presentation. The completion of a professional quality report based on the internship experience. Review of problems in ethics and professional development.

APDS – Applied Design

APDS 430 Advanced Problems in Advertising Design (3)
Two studio periods per week. *Prequisites: APDS 320; and APDS 331. For advertising design majors only.* Advanced problems in design and layout planned for developing competency in one or more areas of advertising design.

APDS 431 Advanced Problems in Advertising Design (3)
Two studio periods per week. *Prequisite: APDS 430. For advertising design majors only.* Advanced problems in design and layout planned for developing competency in one or more areas of advertising design.

APDS 437 Advanced Photography (3)
Three studio periods per week. Continuation of APDS 337.

APDS 499 Individual Problems in Applied Design (3-4)
Prerequisite: permission of department. Repeatable to 9 credits. Open only to advanced students who, with guidance, can work independently.

ARCH – Architecture

ARCH 400 Architecture Studio I (6)
Three hours of lecture and nine hours of studio per week. *Prequisite: ARCH majors only.* Introduction to the processes of visual and architectural design including field problems.

ARCH 401 Architecture Studio II (6)
Three hours of lecture and nine hours of studio per week. *Prequisite: ARCH 400 with a grade of C or better. For ARCH majors only.* Continuation of ARCH 400.

ARCH 402 Architecture Studio III (6)
Three hours of lecture and nine hours of studio per week. *Prequisite: ARCH 401 with a grade of C or better. For ARCH majors only.* Design projects involving the elements of environmental control, basic structural systems, building processes and materials.

ARCH 403 Architecture Studio IV (6)
Prerequisite: ARCH 402 with a grade of C or better. For ARCH majors only. Three hours of lecture and nine hours of studio per week. Design projects involving forms generated by different structural systems, environmental controls and methods of construction.

ARCH 408 Selected Topics in Architecture Studio (1-6)
Prerequisite: ARCH 403 or equivalent and permission of department. Repeatable to 6 credits if content differs. Topical problems in architecture and urban design.

ARCH 412 Architectural Structures II (3)
Prerequisite: ARCH 312, ARCH 400. For ARCH majors only. Design of steel, timber, and reinforced concrete elements, and subsystems; analysis of architectural building systems. Introduction to design for both natural and man-made hazards.

ARCH 414 Solar Energy Applications For Buildings (3)
Prerequisite: ARCH 313 or permission of department. Methods of utilizing solar energy to provide heating, cooling, hot water, and electricity for buildings and related techniques for reducing energy consumption.

ARCH 415 Environmental Control and Systems II (3)
Prerequisite: ARCH 313, ARCH 402. For ARCH majors only. Theory, quantification, and architectural design applications for water systems, fire protection, electrical systems, illumination, signal equipment, and transportation systems.

ARCH 418 Selected Topics in Architectural Science (1-4)
Prerequisite: permission of department. Repeatable to 7 credits if content differs.

ARCH 419 Independent Studies in Architectural Science (1-4)
Repeatable to 7 credits. Proposed work must have a faculty sponsor and receive approval of the curriculum committee.

ARCH 420 History of American Architecture (3)
Prerequisite: ARCH 221 or permission of department. American architecture from the late 17th to the 20th century.

ARCH 422 History of Greek Architecture (3)
Prerequisite: ARCH 220 or permission of department. Survey of Greek architecture from 750-100 B.C.

ARCH 423 History of Roman Architecture (3)
Prerequisite: ARCH 220 or permission of department. Survey of Roman architecture from 500 B.C. To A.D. 325.

ARCH 427 Theories of Architecture (3)
Prerequisite: ARCH 221 or permission of department. For ARCH majors only. Selected historical and modern theories of architectural design.

ARCH 428 Selected Topics in Architectural History (1-3)
Prerequisite: permission of department. Repeatable to 7 credits if content differs.

ARCH 429 Independent Studies in Architectural History (1-4)
Repeatable to 6 credits. Proposed work must have a faculty sponsor and receive approval of the curriculum committee.

ARCH 432 History of Medieval Architecture (3)
Prerequisite: ARCH 220 or permission of department. Architecture of western Europe from the early Christian and Byzantine periods through the late Gothic, with consideration of parallel developments in the eastern world.

ARCH 433 History of Renaissance Architecture (3)
Prerequisite: ARCH 221 or permission of department. Renaissance architectural principles and trends in the 15th and 16th centuries and their modifications in the Baroque period.

ARCH 434 History of Modern Architecture (3)
Prerequisite: ARCH 221 or permission of department. Architectural trends and principles from 1750 to the present, with emphasis on developments since the mid-19th century.

ARCH 436 History of Islamic Architecture (3)
Prerequisite: ARCH 220 or permission of department. Survey of Islamic architecture from the seventh through the eighteenth century.

ARCH 437 History of Pre-Columbian Architecture (3)
Architecture of Pre-Columbian Mexico and Central America from the Pre-Classic Period through the Spanish conquest.

ARCH 442 Studies in Visual Design (3)
Prerequisite: ARCH 401. Studio work in visual design independent of architectural problem solving.

ARCH 445 Visual Analysis of Architecture (3)
Two hours of lecture and two hours of studio per week. *Prerequisite: ARCH 401 and ARCH 343, or permission of department.* Visual principles of architectural design through graphic analysis.

ARCH 448 Selected Topics in Visual Studies (1-4)
Prerequisite: permission of department. Repeatable to 7 credits if content differs.

ARCH 449 Independent Studies in Visual Studies (1-4)
Repeatable to 6 credits. Proposed work must have a faculty sponsor and receive approval of the curriculum committee.

ARCH 450 Introduction to Urban Planning (3)
Introduction to city planning theory, methodology and techniques, dealing with normative, urban, structural, economic, social aspects of the city; urban planning as a process. Architectural majors or by permission of the instructor. Lecture, seminar, 3 hours per week.

ARCH 451 Urban Design Seminar (3)
Prerequisite: ARCH 350 or permission of department. Advanced investigation into problems of analysis and evaluation of the design of urban areas, spaces and complexes with emphasis on physical and social considerations, effects of public policies, through case studies. Field observations.

ARCH 453 Urban Problems Seminar (3)
Prerequisite: permission of department. A case study of urban development issues, dealing primarily with socio-economic aspects of changes in the built environment.

ARCH 454 Theories of Urban Form (3)
Theories of planning and design of urban spaces, building complexes, and new communities.

ARCH 458 Selected Topics in Urban Planning (1-4)
Prerequisite: permission of department. Repeatable to 7 credits if content differs.

ARCH 459 Independent Studies in Urban Planning (1-4)
Repeatable to 6 credits. Proposed work must have a faculty sponsor and receive approval of the curriculum committee.

ARCH 460 Site Analysis and Design (3)
Prerequisite: ARCH majors only or permission of department. Principles and methods of site analysis; the influence of natural and man-made site factors on site design and architectural form.

ARCH 461 Design and Energy (3)
Two hours of lecture and two hours of laboratory per week. *Prerequisite: ARCH 402 and ARCH 415.* Energy strategies in building related to the broader context of architectural problem solving.

ARCH 470 Computer Applications in Architecture (3)
Prerequisite: ARCH 400 or permission of department. Introduction to computer programming and utilization, with emphasis on architectural applications.

ARCH 472 Economic Determinants in Architecture (3)
Introduction to economic factors influencing architectural form and design, including land economics, real estate, financing, project development, financial planning, construction and cost control.

ARCH 478 Selected Topics in Architecture (1-4)
Prerequisite: permission of department. Repeatable to 7 credits if content differs.

ARCH 479 Independent Studies in Architecture (1-4)
Repeatable to 6 credits. Proposed work must have a faculty sponsor and receive approval of the curriculum committee.

ARCH 480 Problems and Methods of Architectural Preservation (3)
Prerequisite: ARCH 420 or permission of department. Theory and practice of preservation in America, with emphasis on the problems and techniques of community preservation.

ARCH 481 The Architect in Archaeology (3)
Prerequisite: permission of department. The role of the architect in field archaeology and the analysis of excavating, recording, and publishing selected archaeological expeditions.

ARCH 482 The Archaeology of Roman and Byzantine Palestine (3)
Archaeological sites in Palestine (Israel and Jordan) from the reign of Herod the Great to the Moslem conquest.

ARCH 483 Field Archaeology (3)
Prerequisite: permission of department. Participation in field archaeology with an excavation officially recognized by proper authorities of local government.

ARCH 488 Selected Topics in Architectural Preservation (1-4)
Prerequisite: permission of department. Repeatable to 7 credits if content differs.

ARCH 489 Independent Studies in Architectural Preservation (1-4)
Repeatable to 6 credits. Proposed work must have a faculty sponsor and receive approval of the curriculum committee.

ARCH 600 Architecture Studio V (6)
Three hours of lecture and nine hours of studio per week. *Prerequisite: ARCH 403 or equivalent.* Comprehensive building and urban design; studio options in advanced topical problems.

ARCH 601 Architecture Studio VI (6)
Three hours of lecture and nine hours of studio per week. *Prerequisite: ARCH 600.* Continuation of ARCH 600.

ARCH 610 Appropriate Technologies in Architecture (3)
Historical and current theories, practices and attitudes regarding the application of technologies to design and construction of buildings, civil structures and other infrastructures in rural and urban environments.

ARCH 612 Advanced Structural Analysis in Architecture (3)
Prerequisite: ARCH 416. Qualitative and quantitative analysis and design of selected complex structural systems.

ARCH 613 Structural Systems in Architecture (3)
Prerequisite: ARCH 416 or permission of instructor. Theory and application of selected complex structural systems as they relate to architectural decisions.

ARCH 614 Environmental Systems in Architecture (3)
Prerequisite: ARCH 415 and ARCH 417 or permission of instructor. Qualitative analysis of selected environmental systems and design determinants.

ARCH 616 Advanced Architectural Structures (3)
Prerequisite: ARCH 375, ARCH 403, ARCH 412, ARCH 415 or equivalent. For ARCH majors only. Analysis of structural issues in architectural design; structure as an architectural form determinant; integration of architectural, structural and other technical disciplines in building design.

ARCH 617 Advanced Environmental Control and Systems (3)
Prerequisite: ARCH 375, ARCH 403, ARCH 412, ARCH 415 or equivalent. For ARCH majors only. Analysis, computer applications, and integration of environmental control and systems in architectural design.

ARCH 621 Seminar in History of American Architecture (3)
Prerequisite: ARCH 221 or ARCH 222 or permission of instructor. Advanced investigation of historical problems in American architecture.

ARCH 628 Selected Topics in Architectural History (1-3)
Prerequisite: permission of department. Repeatable to 7 credits if content differs. Special topics in the history of architecture.

ARCH 629 Independent Studies in Architectural History (1-3)
Repeatable to 7 credits if content differs. Proposed work must have faculty sponsor and receive approval of the Educational Policy Committee.

ARCH 635 Seminar in the History of Modern Architecture (3)
Prerequisite: ARCH 434 or permission of department. Advanced investigation of historical problems in modern architecture.

ARCH 654 Urban Development and Design Theory (3)
Prerequisite: permission of instructor. Advanced investigation into planning, development, and urban design theory and practice.

ARCH 674 Seminar in Regionalism (3)
Prerequisite: permission of department. Regional characterisitics of culture, climate, and landscape as determinants of vernacular architecture, especially in Third World countries.

ARCH 675 Advanced Architectural Construction and Materials (3)
Prerequisite: ARCH 375, ARCH 403, ARCH 412, ARCH 415. For ARCH majors only. Processes of construction, assembly, integration, and coordination of architectural, mechanical, electrical, and structural aspects of building; special attention to design development of building details.

ARCH 676 Field Research in Architecture (3)
Prerequisite: permission of department. Recording and analysis of significant architectural complexes in situ.

ARCH 678 Selected Topics in Architecture (1-6)
Prerequisite: permission of instructor. Repeatable to 6 credits if content differs.

ARCH 679 Independent Studies in Architecture (1-6)
Prerequisite: permission of instructor. Repeatable to 6 credits.

ARCH 700 Architecture Studio VII (6)
Three hours of lecture and nine hours of studio per week. *Prerequisite: ARCH 601.* Continuation of ARCH 601.

ARCH 770 Professional Practice (3)
Prerequisite: ARCH 601. Project management, organizational, legal, economic and ethical aspects of architecture.

ARCH 797 Thesis Proseminar (3)
Prerequisite: ARCH 601. Directed research and preparation of thesis program.

ARCH 799 Master's Thesis Research (1-6)

AREC – Agriculture and Resource Economics

AREC 404 Prices of Agricultural Products (3)
Prerequisite: ECON 403. An introduction to agricultural price behavior. The use of price information in the decision-making process, the relation of supply and demand in determining agricultural prices, and the relation of prices to grade, time, location, and stages of processing in the marketing system. Elementary methods of price analysis, the concept of parity and the role of price support programs in agricultural decisions.

AREC 405 Economics of Agricultural Production (3)
Prerequisite: ECON 403 and MATH 220. The use and application of production economics in agriculture and resource industries through graphical and mathematical approaches. Production functions, cost functions, multiple product and joint production, and production processes through time.

AREC 407 Agricultural Finance (3)
Prerequisite: AREC 250. Application of economic principles to develop criteria for a sound farm business, including credit source and use, preparing and filing income tax returns, methods of appraising farm properties, the summary and analysis of farm records, leading to effective control and profitable operation of the farm business.

AREC 414 Agricultural Business Management (3)
Prerequisite: AREC 250. The different forms of businesses. Management functions, business indicators, measures of performance, and operational analysis. Case studies are used to show applications of management techniques.

AREC 427 Economics of Agricultural Marketing Systems (3)
Prerequisite: AREC 250. Basic economic theory as applied to the marketing of agricultural products, including price, cost, and financial analysis. Current developments affecting market structure including effects of contractual arrangement, vertical integration, governmental policies and regulation.

AREC 432 Introduction to Natural Resources Policy (3)
Development of natural resource policy and analysis of the evolution of public intervention in the use of natural resources. Examination of present policies and of conflicts between private individuals, public interest groups, and government agencies.

AREC 433 Food and Agricultural Policy (3)
Prerequisite: AREC 250. Economic and political context of governmental involvement in the farm and food sector. Historical programs and current policy issues. Analysis of economic effects of agricultural programs, their benefits and costs, and comparison of policy alternatives. Analyzes the interrelationship among international development, agricultural trade and general economic and domestic agricultural policies.

AREC 445 Agricultural Development in the Third World (3)
Prerequisite: ECON 203 or ECON 205 or AREC 250. Development theories, the role of agriculture in economic development, the agricultural policy environment, policies impacting on rural income and equity, environmental impacts of agricultural development.

AREC 453 Natural Resources and Public Policy (3)
Prerequisite: AREC 250 and ECON 203. Rational use and reuse of natural resources. Theory, methodology, and policies concerned with the allocation of natural resources among alternative uses. Optimum state of conservation, market failure, safe minimum standard, and cost-benefit analysis.

AREC 484 Introduction to Econometrics in Agriculture (3)
An introduction to the application of econometric techniques to agricultural problems with emphasis on the assumptions and computational techniques necessary to derive statistical estimates, test hypotheses, and make predictions with the use of single equation models. Includes linear and non-linear regression models, internal least squares, discriminant analysis and factor analysis.

AREC 489 Special Topics in Agricultural and Resources Economics (3)
Repeatable to 9 credits.

AREC 610 Microeconomic Applications in Agricultural and Resource Markets (3)
Prerequisite: ECON 603. Applications of graduate level microeconomic analysis to the problems of agricultural and natural resource production and distribution including demand for agricultural output, the nature of agricultural supply decisions, farm labor issues, land rental and aquisition, and exploitation of natural resources.

AREC 615 Agricultural and Resource Economics Research Techniques (3)
Philosophy and basic objectives of research in the field of agricultural and resource economics. Topics include definition of research problems, logical procedures for executing research in the social sciences, techniques and tools available to agricultural and resource economists, and appraisal of research documents from the standpoint of procedures and evaluation of research.

AREC 620 Optimization in Agricultural and Resource Economics (3)
Prerequisite: differential calculus and one course in matrix or linear algebra. Mathematical theory of optimization as it is used in agricultural and resource economics. Topics include necessary and sufficient conditions for nonlinear programming and related Kuhn-Tucker and saddle point theory, convexity and concavity, existence and uniqueness, duality and the envelope theorem, the discrete maximum principle, and control theory and dynamic optimization.

AREC 625 Economic Welfare Analysis (3)
Credit will be granted for only one of the following: AREC 625 or AREC 825. The measurement of economic well-being for producers, consumers, and resource owners. Topics include competitive equilibrium, Pareto optimality, market failure, public goods and nonmarket welfare measurement, multimarket considerations, existing distortions, and second best. Applications in economic welfare analysis of agricultural and resource policies are discussed.

AREC 632 Agricultural Policy Analysis (3)
Credit will be granted for only one of the following: AREC 632 or AREC 832. The economics of agricultural policies. Methods for analyzing costs and benifits of price supports, import restraints, and other policies for producers, consumers, and taxpayers. Farm programs of the U.S., other industrial countries and developing countries including interventions in both domestic markets and international are covered along with their consequences for factor owners and related commodity markets. Theories of the farm problem and possible remedies are offered.

AREC 644 International Agricultural and Resource Trade (3)
Credit will be granted for only one of the following: AREC 644 or AREC 844. An introduction to trade in agricultural products and natural resources. Partial and general equilibrium models as applied to problems in agricultural and and natural resource trade and in analyzing related trade policies of various countries to understand the impact of macroeconomic policy on international agricultural and resource markets through exchange rates, interest rates and inflation.

AREC 645 International Agricultural Development (3)
Credit will be granted for only one of the following: AREC 645 or AREC 845. Microeconomic foundations of agricultural development, the behavior of the farm household as an economic unit, and the functioning of the agricultural product, input, and labor markets in developing economies. The role of agriculture in economic development is discussed with emphasis on the basic linkages between agriculture and the rest of the economy.

AREC 685 Applications of Mathematical Programming in Agriculture Business and Analysis (3)
Prerequisite: ECON 403 or permission of department. Application of mathematical programming to problems in agriculture and resource economics. Emphasis on modeling large-scale systems and interpreting results in economic terms.

AREC 689 Special Topics in Agricultural and Resource Economics (3)
Subject matter taught will be varied and will depend on the persons available for teaching unique and specialized phases of agricultural and resource economics. The course will be taught by the staff or visiting agricultural and resource economists who may be secured on lectureship or visiting professor basis.

AREC 699 Special Problems in Agricultural and Resource Economics (1-2)
Intensive study and analysis of specific problems in the field of agricultural and resource economics, which provide information in depth in areas of special interest to the student.

AREC 753 Economics of Renewable Natural Resources (3)
Prerequisite: AREC 610; and AREC 620; or permission of department. Basic models of renewable natural resources. Current research issues concerning natural resources with emphasis on problems in commercial and recreational fisheries, forestry, water, fugitive wildlife, and agriculture. Policies to correct related market failures.

AREC 799 Master's Thesis Research (1-6)

AREC 804 Advanced Agricultural Price and Demand Analysis (3)
Prerequisite: ECON 603 and AREC 610. Theories of household behavior and mechanisms of price determination. Static as well as intertemporal optimization problems arising from the simultaneous determination of savings and commodity demand with habit formation. Role of inventories in price formation, factors determining the degree of price flexibility, and price formation in noncompetitive industries.

AREC 806 Advanced Agricultural Production Analysis (3)
Prerequisite: ECON 603 and AREC 610. Theory and methods of applied production analysis. Use of dual methods in the analysis of agricultural production problems, cost and profit functions, separability, technical change, aggregation, index numbers, and dynamic decision making.

AREC 825 Advanced Economic Welfare Analysis (3)
Credit will be granted for only one of the following: AREC 625 or AREC 825. Theory of economic welfare measurement, problems of path dependence in evaluating multiple price changes, welfare measurement under risk, general equilibrium welfare measurement with multiple distortions, and applications in evaluation of agricultural and resource policies.

AREC 832 Advanced Agricultural Policy Analysis (3)
Credit will be granted for only one of the following: AREC 632 or AREC 832. Research problems in agricultural policy that include models and methods for explaining the consequences and causes of intervention in agricultural commodity markets. Quantitative, market level analysis of the implications of uncertainty, strategic behavior in international trade, second-best policies, the general equilibrium analysis of intervention, and the political economy of collective action in farm policy.

AREC 844 Advanced International Agricultural and Resource Trade (3)
Credit will be granted for only one of the following: AREC 644 or AREC 844. Issues and problems of current interest in agricultural trade policy and research. Use of dual methods in international trade, the effect of international financial markets on agricultural trade and agriculture in general, the efficient design of agricultural trade policy, trade in resources, and measuring the gains from trade in any economy distorted by sectoral policies.

AREC 845 Advanced International Agricultural Development (3)
Credit will be granted for only one of the following: AREC 645 or AREC 845. Economic inequalities and market forces in economic development along with strategies and policies for economic development. Export oriented versus import substitution strategies, the role of foreign capital and debt accumulation in the agricultural sector, and the effects of government intervention on agricultural development. Case studies of selected Latin American, Asian and African countries.

AREC 859 Advanced Topics in Natural Resource Economics (1-3)
Repeatable to 9 credits if content differs. Intertemporal considerations in natural resource problems including irreversibility and stochastic control. Nonmarket welfare measurement and nonconsumptive values, option/quasi-option and existence values, applications to extinction and uncertainty, and alternative expectations in common property resource problems.

AREC 869 Advanced Topics in Agricultural Economics (1-3)
Repeatable to 9 credits if content differs. Frontiers of research in agricultural policy, agricultural production, international trade, and agricultural development. Decision making under risk and related market institutions, principal agent analysis, optimal policy design, technology adoption, market structure, land and credit markets, information markets, and income distribution.

AREC 899 Doctoral Dissertation Research (1-8)

ARTH – Art History

ARTH 400 Egyptian Art and Archaeology (3)
Formerly ARTH 404. Sites and monuments of painting, sculpture, architecture, and the minor arts of ancient Egypt from earliest times through the Roman conquest. Emphasis on the pharaonic period.

ARTH 401 Aegean Art and Archaeology (3)
Formerly ARTH 404. Sites and monuments of painting, sculpture, architecture, and the minor arts of Crete, the Cycladic islands, and the Greek mainland from the earliest times to the downfall of the Mycenaean.

ARTH 402 Greek Art and Archaeology (3)
Sites and monuments of painting, sculpture, architecture, and the minor arts from the Geometric through the Hellenistic period with emphasis on mainland Greece in the Archaic and Classical periods.

ARTH 403 Roman Art and Archaeology (3)
Sites and monuments of painting, sculpture, architecture, and the minor arts from the earliest times through the third century A.D. with emphasis on the Italian peninsula from the Etruscan period through that of Imperial Rome.

ARTH 405 Late Roman and Early Christian Art (3)
Formerly ARTH 410. Painting, sculpture, architecture, and the minor arts from the early third century through the sixth century A.D.

ARTH 406 Byzantine Art (3)
Formerly ARTH 411. Painting, sculpture, architecture, and the minor arts from the seventh century to 1453 A.D.

ARTH 410 Early Medieval Art (3)
Formerly ARTH 412. Painting, sculpture and architecture in Western Europe, ca. 500-1150.

ARTH 411 Gothic Art (3)
Formerly ARTH 413. Painting, sculpture and architecture in Western Europe, ca. 1150-1400.

ARTH 415 Italian Renaissance Art (3)
Formerly ARTH 424. Painting, sculpture and architecture of the fifteenth and sixteenth centuries.

ARTH 418 Special Problems in Italian Renaissance Art (3)
Repeatable to 6 credits if content differs. Focus upon Aspects of painting, sculpture, and architecture of Renaissance.

ARTH 420 Fourteenth and Fifteenth-Century Northern European Art (3)
Formerly ARTH 416. The art of northern Europe with an emphasis on painting in the Netherlands and France.

ARTH 425 Sixteenth-Century Northern European Painting (3)
Formerly ARTH 417. Painting in France, Germany, England, and the Low Countries during the Renaissance and Reformation.

ARTH 426 Renaissance and Baroque Sculpture in Northern Europe (3)
Sculpture in France, Germany, England, and the Low Countries from the fourteenth to the seventeenth century.

ARTH 430 Seventeenth-Century European Art (3)
Painting, sculpture and architecture concentrating on Italy, Spain, France, and England.

ARTH 435 Seventeenth-Century Art in the Netherlands (3)
Formerly ARTH 431. Painting, sculpture and architecture in seventeenth-century Netherlands.

ARTH 443 Eighteenth-Century European Art (3)
From the Rococo to Neo-classicism, major developments in painting, architecture, sculpture, and the landscape garden in eighteenth-century France, England, Italy, Spain, and Germany.

ARTH 444 British Painting, Hogarth to the Pre-Raphaelites (3)
A survey of British painting focusing on the establishment of a strong native school in the genres of history painting, narrative subjects, portraiture, sporting art, and landscape.

ARTH 445 Nineteenth-Century European Art to 1850 (3)
Formerly ARTH 440. The major trends from Neo-Classicism to Romanticism in painting, sculpture and architecture in Europe.

ARTH 446 Nineteenth-Century European Art from 1850 (3)
Formerly ARTH 441. The major trends from Realism through Impressionism to Symbolism and Art Nouveau, in painting, sculpture, and architecture.

ARTH 452 Nineteenth-Century Black American Art (3)
Formerly ARTH 473. The visual arts of Black Americans from the Colonial period through the nineteenth century, including crafts and decorative arts.

ARTH 453 History of American Art to 1876 (3)
Painting, sculpture, architecture, and decorative arts in North America from the colonial period to 1876.

ARTH 454 Nineteenth and Twentieth Century Sculpture (3)
Trends in sculpture from Neo-Classicism to the present.

ARTH 455 Twentieth-Century Art to 1945 (3)
Formerly ARTH 450. Painting, sculpture and architecture in Europe and America from the late nineteenth century to the end of World War II.

ARTH 456 Twentieth-Century Art from 1945 (3)
Formerly ARTH 451. Painting, sculpture and architecture in Europe and America from 1945 to the present.

ARTH 457 History of Photography (3)
Formerly ARTH 452. History of photography as art from its inception in 1839 to the present.

ARTH 460 American Art Since 1876 (3)
Formerly ARTH 477. Painting, sculpture, architecture, and the decorative arts in North America after 1876.

ARTH 462 Twentieth-Century Black American Art (3)
Formerly ARTH 474. The visual arts of Black Americans in the twentieth century, including crafts and decorative arts.

ARTH 466 Feminist Perspectives on Women in Art (3)
Principal focus on European and American women artists of the 19th and 20th centuries, in the context of the new scholarship on women.

ARTH 470 Latin American Art and Archaeology before 1500 (3)
Pre-Hispanic painting, sculpture, and architecture, with a focus on the major archaeological monuments of Mexico.

ARTH 471 Latin American Art and Archaeology after 1500 (3)
The effect of mingling European visual ideas with pre-Hispanic traditions. The formation of Latin American colonial art. How native American people transformed European ideas and forms.

ARTH 475 Ancient Art of Africa (3)
Formerly ARTH 462. Art of the African continent from rock art through the nineteenth century. The cultural meaning of painting, sculpture, architecture, and artifacts from major archeological sites.

ARTH 476 Living Art of Africa (3)
Formerly ARTH 463. Art styles among the segmentary, centralised and nomadic people of Africa. The iconography and function of their art and its relationship to their various societies, cults and ceremonies.

ARTH 483 Structure and Analysis of Art (3)
Basic concepts of structuralism applied to the analysis of art. Visual examples, including photography, cartoons, painting, and sculpture, emphasize the underlying logic of narrative themes in Western art ranging from the time of Giotto to the present.

ARTH 489 Special Topics in Art History (3)
Prerequisite: permission of department. Repeatable to 6 credits.

ARTH 490 Chinese Painting (3)
Chinese painting history from the second century B.C. through the twentieth century, covering cultural, stylistic and theoretical aspects.

ARTH 495 Japanese Painting (3)
Formerly ARTH 405. Japanese painting from the sixth through the nineteenth century, including Buddhist icon painting, narrative scrolls, and Zen-related ink painting.

ARTH 498 Directed Studies in Art History I (2-3)
Prerequisite: permission of department. Repeatable if content differs. Junior standing.

ARTH 499 Directed Studies in Art History II (2-3)

ARTH 608 Studies in Ancient Art and Archaeology (3)
Repeatable to 9 credits each in the Master's and Ph.D. programs.

ARTH 609 Studies in Late Roman, Early Christian, and Byzantine Art (3)
Repeatable to 9 credits each in the Master's and Ph.D. programs.

ARTH 618 Studies in Medieval Art (3)
Repeatable to 9 credits each in the Master's and Ph.D. programs.

ARTH 619 Studies in Italian Renaissance Art (3)
Repeatable to 9 credits each in the Master's and Ph.D. programs.

ARTH 628 Studies in Fourteenth and Fifteenth Century Northern European Art (3)
Repeatable to 9 credits each in the Master's and Ph.D. programs.

ARTH 629 Studies in Sixteenth-Century Northern European Art (3)
Repeatable to 9 credits each in the Master's and Ph.D. programs.

ARTH 638 Studies in Seventeenth-Century Southern European Art (3)
Repeatable to 9 credits each in the Master's and Ph.D. programs.

ARTH 639 Studies in Seventeenth-Century Northern European Art (3)
Repeatable to 9 credits each in the Master's and Ph.D. programs.

ARTH 648 Studies in Eighteenth-Century European Art (3)
Repeatable to 9 credits each in the Master's and Ph.D. programs.

ARTH 649 Studies in Nineteenth-Century European Art (3)
Repeatable to 9 credits each in the Master's and Ph.D. programs.

ARTH 658 Studies in American Art (3)
Repeatable to 9 credits each in the Master's and Ph.D. programs.

ARTH 659 Studies in Twentieth-Century Art (3)
Repeatable to 9 credits each in the Master's and Ph.D. programs.

ARTH 668 Studies in Latin American Art and Archaeology (3)
Repeatable to 9 credits each in the Master's and Ph.D. programs.

ARTH 669 Studies in African Art (3)
Repeatable to 9 credits each in the Master's and Ph.D. programs.

ARTH 678 Studies in Chinese Art (3)
Repeatable to 9 credits each in the Master's and Ph.D. programs.

ARTH 679 Studies in Japanese Art (3)
Repeatable to 9 credits each in the Master's and Ph.D. programs.

ARTH 689 Selected Topics in Art History (3)
Repeatable to 9 credits each in the Master's and Ph.D. programs.

ARTH 692 Methods of Art History (3)
Methods of research and criticism applied to typical art-historical problems; bibliography and other research tools. May be taken for credit one or two semesters.

ARTH 695 Museum Colloquium (3)
Formerly ARTH 698.

ARTH 699 Special Topics in Art History (3)
Prerequisite: consent of department head or instructor.

ARTH 708 Seminar in Ancient Art and Archaeology (3)
Repeatable to 9 credits each in the Master's and Ph.D. programs.

ARTH 709 Seminar in Late Roman, Early Christian, and Byzantine Art (3)
Repeatable to 9 credits each in the Master's and Ph.D. programs.

ARTH 718 Seminar in Medieval Art (3)
Repeatable to 9 credits each in the Master's and Ph.D. programs.

ARTH 719 Seminar in Italian Renaissance Art (3)
Repeatable to 9 credits each in the Master's and Ph.D. programs.

ARTH 728 Seminar in Fourteenth and Fifteenth-Century Northern European Art (3)
Repeatable to 9 credits each in the Master's and Ph.D. programs.

ARTH 729 Seminar in Sixteenth-Century Northern European Art (3)
Repeatable to 9 credits each in the Master's and Ph.D. programs.

ARTH 738 Seminar in Seventeenth-Century Southern European Art (3)
Repeatable to 9 credits each in the Master's and Ph.D. programs.

ARTH 739 Seminar in Seventeenth-Century Northern European Art (3)
Repeatable to 9 credits each in the Master's and Ph.D. programs.

ARTH 748 Seminar in Eighteenth-Century European Art (3)
Repeatable to 9 credits each in the Master's and Ph.D. programs.

ARTH 749 Seminar in Nineteenth-Century European Art (3)
Repeatable to 9 credits each in the Master's and Ph.D. programs.

ARTH 758 Seminar in American Art (3)
Repeatable to 9 credits each in the Master's and Ph.D. programs.

ARTH 759 Seminar in Twentieth-Century Art (3)
Repeatable to 9 credits each in the Master's and Ph.D. programs.

ARTH 768 Seminar in Latin American Art and Archaeology (3)
Repeatable to 9 credits each in the Master's and Ph.D. programs.

ARTH 769 Seminar in African Art (3)
Repeatable to 9 credits each in the Master's and Ph.D. programs.

ARTH 778 Seminar in Chinese Art (3)
Repeatable to 9 credits each in the Master's and Ph.D. programs.

ARTH 779 Seminar in Japanese Art (3)
Repeatable to 9 credits each in the Master's and Ph.D. programs.

ARTH 789 Selected Topics in Art History (3)
Repeatable to 9 credits each in the Master's and Ph.D. programs.

ARTH 798 Directed Graduate Studies in Art History (3)

ARTH 799 Master's Thesis Research (1-6)

ARTH 899 Doctoral Dissertation Research (1-8)

ARTT – Art Studio

ARTT 404 Experiments in Visual Processes (3)
Six hours of laboratory per week. *Prerequisite: ARTT 220 or ARTT 330 or ARTT 340. Formerly ARTS 404.* Investigation and execution of process oriented art. Group and individual experimental projects.

ARTT 418 Drawing (3)
Six hours of laboratory per week. *Prerequisite: ARTT 210. Repeatable to 12 credits. Formerly ARTS 418.* Original compositions from the figure and nature, supplemented by problems of personal and expressive drawing.

ARTT 428 Painting (3)
Six hours of laboratory per week. *Prerequisite: ARTT 320. Repeatable to 12 credits. Formerly ARTS 428.* Original compositions based upon nature, figure, still life and expressive painting emphasizing development of personal directions.

ARTT 438 Sculpture (3)
Six hours of laboratory per week. *Prerequisites: one 300-level sculpture course; and permission of department. Repeatable to 12 credits. Formerly ARTS 438.* Continuation of 300-level elements of sculpture courses with emphasis on developing personal directions in chosen media.

ARTT 448 Printmaking (3)
Six hours of laboratory per week. *Prerequisites: one 300-level printmaking course; and permission of department. Repeatable to 12 credits. Formerly ARTS 448.* Continuation of 300-level elements of printmaking courses with emphasis on developing personal directions in chosen media.

ARTT 468 Advanced Seminar in Studio Art (3)
Three hours of laboratory and three hours of discussion/recitation per week. *Prerequisite: permission of department. Repeatable to 6 credits. Formerly ARTS 468.* Relationship of student's work to historical and contemporary context.

ARTT 489 Special Problems in Studio Arts (3)
Prerequisite: permission of department. Repeatable to 6 credits. Formerly ARTS 489.

ARTT 498 Directed Studies in Studio Art (2-3)
Prerequisite: permission of department. For advanced students. Repeatable if content differs. Formerly ARTS 498.

ARTT 610 Drawing (3)
Formerly ARTS 610. Sustained treatment of a theme chosen by student. Wide variety of media.

ARTT 614 Drawing (3)
Formerly ARTS 614. Traditional materials and methods including oriental, sumi ink drawing and techniques of classical european masters.

ARTT 616 Drawing (3)
Formerly ARTS 616. Detailed anatomical study of the human figure and preparation of large scale mural compositions.

ARTT 620 Painting (3)
Formerly ARTS 620.

ARTT 624 Painting (3)
Formerly ARTS 624.

ARTT 626 Painting (3)
Formerly ARTS 626.

ARTT 627 Painting (3)
Formerly ARTS 627.

ARTT 630 Experimentation in Sculpture (3)
Formerly ARTS 630.

ARTT 634 Experimentation in Sculpture (3)
Formerly ARTS 634.

ARTT 636 Materials and Techniques in Sculpture (3)
For advanced students. *Formerly ARTS 636.* Methods of armature building, and the use of a variety of stone, wood, metal and plastic materials.

ARTT 637 Sculpture: Casting and Foundry (3)
Formerly ARTS 637. The traditional methods of plaster casting and the complicated types involving metal, cire perdue, sand-casting and newer methods, such as cold metal process.

ARTT 640 Printmaking (3)
Formerly ARTS 640. Advanced problems. Relief process.

ARTT 644 Printmaking (3)
Formerly ARTS 644. Advanced problems. Intaglio process.

ARTT 646 Printmaking (3)
Formerly ARTS 646. Advanced problems. Lithographic process.

ARTT 647 Seminar in Printmaking (3)
Formerly ARTS 647.

ARTT 689 Special Problems in Studio Art (3)
Prerequisite: permission of instructor. Repeatable to 6 credits. Formerly ARTS 689.

ARTT 690 Drawing and Painting (3)
Formerly ARTS 690. Preparation and execution of a wall decoration.

ARTT 698 Directed Graduate Studies in Studio Art (3)
Prerequisites: for advanced graduate students by permission of department head. Course may be repeated for credit if content differs. Formerly ARTS 698.

ARTT 798 Directed Graduate Studies in Studio Art (3)
Formerly ARTS 798.

ARTT 799 Master's Thesis Research (1-6)
Formerly ARTS 799.

ASTR – Astronomy

ASTR 400 Stellar Astrophysics (3)
Prerequisite: ASTR 350. Corequisite: PHYS 420 or PHYS 421. Radiation processes in stars and interstellar space, stellar atmospheres, stellar structure and evolution.

ASTR 410 Observational Astronomy I (3)
Prerequisites: PHYS 294 or PHYS 263; and 3 credits in astronomy. An introduction to current methods of obtaining astronomical information. Emphasis on optical and radio techniques, with brief coverage of X-ray, ultraviolet, and infrared techniques. Emphasis on understanding how instruments affect the data.

ASTR 411 Observational Astronomy II (3)
Prerequisite: ASTR 410. Laboratory work with photographic and photoelectric techniques and with components of radio telescopes. Two longer individual projects involving observations with various instruments. Often requires all-night observing sessions.

ASTR 420 Introduction to Galactic Research (3)
Prerequisite: PHYS 272 and ASTR 350 or equivalent or permission of department. Methods of galactic research, stellar motions, clusters of stars, evolution of the galaxy, study of our own and nearby galaxies.

ASTR 430 The Solar System (3)
Prerequisite: MATH 246 and either PHYS 263 or PHYS 273, or permission of department. The structure of planetary atmospheres, radiative transfer in planetary atmospheres, remote sensing of planetary surfaces, interior structure of planets. Structure of comets. Brief discussions of asteroids, satellite systems, and solar system evolution. Intended for students majoring in any of the physical sciences.

ASTR 440 Introduction to Extra-Galactic Astronomy (3)
Prerequisite: PHYS 272 and ASTR 350 or equivalent, or permission of department. Properties of normal and peculiar galaxies, including radio galaxies and quasars; expansion of the universe and cosmology.

ASTR 450 Celestial Mechanics (3)
Prerequisite: PHYS 410 or permission of department. Celestial mechanics, orbit theory, equations of motion.

ASTR 498 Special Problems in Astronomy (1-6)
Prerequisite: major in physics or astronomy or permission of department. Research or special study. Credit according to work done.

ASTR 600 Stellar Atmospheres (3)
Prerequisite: ASTR 422 or permission of department. Structure of stellar atmospheres, survey of atomic and molecular physics, absorption coefficients and radiative transfer, numerical techniques, calculation of model atmospheres and comparison with observations, discussion of line profiles, stellar winds and coronae.

ASTR 605 Stellar Interiors and Evolution (3)
Prerequisite: PHYS 410, PHYS 422 or equivalent. Energy transfer and generation in the interior of a star, evolution of stars, nucleosynthesis, variable stars, explosive stars, neutron stars and black holes.

ASTR 610 Astronomical Instrumentation and Techniques (3)
Prerequisite: PHYS 405 or permission of department. Review of Maxwell's equations; designs of telescopes, spectrographs, modern detectors; basic concepts for radio detectors and telescopes; interferometry and data processing.

ASTR 620 Galaxies (3)
Prerequisite: ASTR 400 or permission of department. Galaxy classifications; Milky way: basic data, distribution of stars, gas, dust and relativistic particles, large-scale structure and rotation; Spiral galaxies: stellar dynamics and stability, density waves, star bursts, galactic center; Elliptical galaxies: stellar dynamics, cannabalism; galaxy formation.

ASTR 630 Physics of the Solar System (3)
Prerequisite: PHYS 422. A survey of the problems of interplanetary space, the solar wind, comets and meteors, planetary structure and atmospheres, motions of particles in the earth's magnetic field.

ASTR 640 Radiation and Plasma Processes (3)
Corequisite: PHYS 606 or permission of department. Radiation processes with emphasis on radiation from energetic electrons, synchrotron and inverse-Compton radiation, bremsstrahlung and astrophysical applications. The plasma dielectric and the "zoo" of plasma waves. Use of kinetic theory to derive fluid dynamics; discussion of MHD in its various limits of astrophysical use; some instabilities.

ASTR 670 Interstellar Matter (3)
Prerequisite: PHYS 422 or permission of department. Photo-ionization processes, classical diagnostics of the interstellar medium, physics of supernova remnants, molecules, dynamics of the formation of clouds and stars, cosmic rays and their acceleration.

ASTR 688 Special Topics in Modern Astronomy (1-3)
Prerequisite: permission of instructor. Special topics such as extragalactic radio sources, plasma astrophysics, the H.R. diagram, chemistry of the interstellar medium, radiophysics of the sun.

ASTR 690 Reasearch Project I (3)

ASTR 691 Research Project II (3)

ASTR 699 Special Problems in Advanced Astronomy (1-6)

ASTR 760 Solar Physics (3)
Prerequisite: PHYS 606. Corequisite: ASTR 640 or PHYS 761, or permission of department. The structure of the solar atmosphere, observations and theoretical interpretation of the solar corona, solar flares, solar cycles and oscillations, and their relationship to other stars.

ASTR 788 Selected Topics in Modern Astronomy (1-3)

ASTR 799 Master's Thesis Research (1-6)

ASTR 899 Doctoral Dissertation Research (1-8)

BCHM – Biochemistry

BCHM 461 Biochemistry I (3)
Prerequisite: CHEM 243 or CHEM 245. A comprehensive introduction to general biochemistry. The chemistry and metabolism of carbohydrates, lipids, nucleic acids, and proteins.

BCHM 462 Biochemistry II (3)
Prerequisite: BCHM 461. A continuation of BCHM 461.

BCHM 463 Biochemistry Laboratory I (2)
Six hours of laboratory per week. *Pre- or corequisite: BCHM 461.*

BCHM 464 Biochemistry Laboratory II (2)
Six hours of laboratory per week. *Prerequisite: CHEM 483 or BCHM 463. Pre- or corequisite: BCHM 462.*

BCHM 666 Biophysical Chemistry (2)
Prerequisites: BCHM 461 and CHEM 482.

BCHM 668 Special Problems in Biochemistry (2-4)
Two to four three-hour laboratory periods per week *Prerequisite: BCHM 464 or equivalent.*

BCHM 669 Special Topics in Biochemistry (2)
Prerequisite: BCHM 462 or equivalent.

BCHM 671 Protein Chemistry and Enzymic Catalysis (3)
Principles of protein structure and function, characterization of active sites, enzyme mechanisms and kinetics, antibody structure.

BCHM 672 Biological Membranes (3)
Organization of biological membranes, metabolism of membrane lipids, membrane proteins, including receptors, membrane functions including bioenergetics and transport, assembly of membranes.

BCHM 673 Regulation of Metabolism (3)
Intracellular milieu, compartmentation, metabolic and enzymic approaches to identifying control points, regulation by covalent modification of enzymes, metabolic disorders.

BCHM 674 Nucleic Acids (3)
Chemistry of nucleotides and polynucleotides, organization of cells and genomes from viruses to eukaryotes, DNA replication, RNA synthesis, ribosome biogenesis, regulation of protein synthesis.

BCHM 699 Special Problems in Biochemistry (1-6)
Prerequisite: one semester of graduate study in biochemistry. Repeatable to 6 credits if content differs. Laboratory experience in a research environment. Restricted to students in the non-thesis M.S. option.

BCHM 799 Master's Thesis Research (1-6)

BCHM 898 Seminar (1)

BCHM 899 Doctoral Dissertation Research (1-8)

BIOL – Biology

BIOL 501 Life Science for Middle School Teachers I (4)
Three lectures and three hours of laboratory per week. An introductory lecture/laboratory course for teachers emphasizing the process and interdependence of living organisms, their general organization and association with humans in natural ecosystems. Discussion of the genetic and evolutionary process involved in the continuity of life.

BIOL 502 Life Science for Middle School Teachers II (4)
Three lectures and three hours of laboratory per week. *Prerequisite: BIOL 501.* A second-level lecture/laboratory course that provides a general introduction to the classification, anatomy and physiology of plants and animals, with a special emphasis on humans.

BIOL 503 Life Science for Middle School Teachers III (4)
Three lectures and three hours of laboratory per week. *Prerequisite: BIOL 502.* A third-level laboratory/field course that investigates the ecology and natural history of the Chesapeake Bay and human's relationship to it.

BIOM – Biometrics

BIOM 401 Biostatistics I (4)
Three hours of lecture and one hour of discussion/recitation per week. *Prerequisite: BIOM 301.* Descriptive statistics, probability models useful in biology, expectations, hypothesis testing, goodness of fit tests, central limit theorem, point and interval estimates, analysis of variance, regression, correlation, sampling, rank tests. Emphasis on the uses and the limitations of these methods in biology.

BIOM 405 Computer Applications in Biometrics (1)
Two hours of laboratory per week. *Corequisite: BIOM 401.* An introduction to computer usage in statistical analyses. Topics include file manipulation, formatting data, transformations, descriptive statistics, graphical displays of data, and several introductory inferential statistical procedures.

BIOM 420 Sampling Techniques in Biometrics (3)
Prerequisite: BIOM 401. Methods of sampling: probability, random, cluster, stratified, inverse; ratio estimates; methods in field surveys: mark recapture studies, line transect sampling; surveys, design of collection forms; sample size calculations. Emphasis on the use of these methods in biological research.

BIOM 602 Biostatistics II (3)
Three hours of lecture and one hour of discussion/recitation per week. *Prerequisite: BIOM 401 or equivalent.* The principles of experimental design and analysis of variance and covariance.

BIOM 603 Biostatistics III (3)
Corequisite: BIOM 604. Prerequisite: BIOM 602; and BIOM 405 or equivalent. Applications of the general linear model to the life sciences.

BIOM 604 Linear Models Computer Laboratory (1)
Two hours of laboratory per week. *Corequisite: BIOM 603. Prerequisite: BIOM 405.* Implementation of linear model analyses common to the life sciences.

BIOM 688 Topics in Biometrics (1-3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs. Advanced topics of current interest in various areas of biometrics. Credit assigned will depend on lecture and/or laboratory time scheduled and organization of the course.

BIOM 698 Special Problems in Biometrics (1-3)
Prerequisite: permission of both department and instructor. Repeatable to 6 credits if content differs. Individual study of a particular topic in biostatistics or biomathematics.

BIOM 699 Seminar in Biometrics (1)

BMGT – Business and Management

BMGT 402 Database and Data Communication Systems (3)
Prerequisite: BMGT 302. Introduction to database and data communications systems. Modeling and database construction using the three data models: network, relational and hierarchical. Implementation project using DMS 1100 database system. Data communications protocols and communications support software. Analysis of distributed systems and computer networks. Emphasis on new technologies.

BMGT 403 Systems Analysis (3)
Prerequisite: BMGT 402. Techniques and tools applicable to the analysis and design of computer based information systems. System life cycle, requirements analysis, logical design of data bases, performance evaluation. Emphasis on case studies. Project required that involves the design, analysis and implementation of an information system.

BMGT 404 Seminar in Decision Support Systems (3)
Prerequisite: BMGT 301. Design of computer systems to solve business problems and to support decision making. Human and organizational factors are considered. Emphasis on case studies.

BMGT 410 Fund Accounting (3)
Prerequisite: BMGT 310. An introduction to the fund-based theory and practice of accounting as applied to governmental entities and not-for-profit associations.

BMGT 417 Advanced Tax Accounting (3)
Prerequisites: BMGT 311; and BMGT 323. Federal taxation of corporations, partnerships, fiduciaries, and gratuitous transfers. Tools and techniques of tax research for compliance and planning.

BMGT 420 Undergraduate Accounting Seminar (3)
Prerequisite: senior standing as an accounting major or permission of department. Enrollment limited to upper one-third of senior class. Seminar coverage of outstanding current non-text literature, current problems and case studies in accounting.

BMGT 421 Undergraduate Accounting Seminar (3)
Prerequisite: senior standing as an accounting major or permission of department. Enrollment limited to upper one-third of senior class. Seminar coverage of outstanding current non-text literature, current problems and case studies in accounting.

BMGT 422 Auditing Theory and Practice (3)
Prerequisite: BMGT 311. A study of the independent accountant's attest function, generally accepted auditing standards, compliance and substantive tests, and report forms and opinions.

BMGT 424 Advanced Accounting (3)
Prerequisite: BMGT 311. Advanced accounting theory applied to specialized topics and current problems. Emphasis on consolidated statements and partnership accounting.

BMGT 426 Advanced Cost Accounting (3)
Prerequisite: BMGT 321. Advanced cost accounting with emphasis on managerial aspects of internal record-keeping and control systems.

BMGT 427 Advanced Auditing Theory and Practice (3)
Prerequisite: BMGT 422. An examination and in-depth study of special auditing topics such as statistical sampling, professional ethics, EDP auditing, legal liability, and SEC accounting.

BMGT 430 Linear Statistical Models in Business (3)
Prerequisite: BMGT 230 or BMGT 231 or permission of department. Model building involving an intensive study of the general linear stochastic model and the applications of this model to business problems. The model is derived in matrix form and this form is used to analyze both the regression and ANOVA formulations of the general linear model.

BMGT 431 Design of Statistical Experiments in Business (3)
Prerequisite: BMGT 230 or BMGT 231. Surveys ANOVA models, basic and advanced experimental design concepts. Non-parametric tests and correlations are emphasized. Applications of these techniques to business problems in primarily the marketing and behavioral sciences are stressed.

BMGT 432 Sample Survey Design For Business and Economics (3)
Prerequisite: BMGT 230; or BMGT 231. Design of probability samples. Simple random sampling, stratified random sampling, systematic sampling, and cluster sampling designs are developed and compared for efficiency under varying assumptions about the population sampled. Advanced designs such as multistage cluster sampling and replicated sampling are surveyed. Implementing these techniques in estimating parameters of business models is stressed.

BMGT 434 Introduction to Optimization Theory (3)
Prerequisite: MATH 220; or permission of department. Primarily for students majoring in management science and statistics. Linear programming, postoptimality analysis, network algorithms, dynamic programming, nonlinear programming and single variable minimization.

BMGT 435 Introduction to Applied Probability Models (3)
Prerequisite: BMGT 231 or permission of department. Statistical models in management. Review of probability theory, Monte Carlo methods, discrete event simulation, Markov chains, queueing analysis, other topics depending upon time. Guass, a higher-level computer language, will be introduced in the class and the students will carry out various exercises using this language.

BMGT 440 Financial Management (3)
Prerequisite: BMGT 340. Analysis and discussion of cases and readings relating to financial decisions of the firm. The application of finance concepts to the solution of financial problems is emphasized.

BMGT 443 Security Analysis and Valuation (3)
Prerequisite: BMGT 343. Study and application of the concepts, methods, models, and empirical findings to the analysis, valuation, and selection of securities, especially common stock.

BMGT 444 Futures Contracts and Options (3)
Prerequisite: BMGT 343. The institutional features and economic rationale underlying markets in futures and options. Hedging, speculation, structure of futures prices, interest rate futures, efficiency in futures markets, and stock and commodity options.

BMGT 445 Commercial Bank Management (3)
Prerequisites: BMGT 340; and ECON 430. Analysis and discussion of cases and readings in commercial bank management. The loan function is emphasized: also the management of liquidity reserves, investments for income, and source of funds. Bank objectives, functions, policies, organization, structure, services, and regulation are considered.

BMGT 451 Consumer Analysis (3)
Prerequisite: BMGT 350. Recommended: PSYC 100; and PSYC 221. Not open to students who have completed CNEC 437. Credit will be granted for only one of the following: BMGT 451 or CNEC 437. American consumers in the marketing system. Underlying consumer behavior such as economic, social, psychological and cultural factors. Analysis of consumers in marketing situations - as a buyer and user of products and services - and in relation to the various individual social and marketing factors affecting their behavior. The influence of marketing communications is also considered.

BMGT 452 Marketing Research Methods (3)
Prerequisites: BMGT 230; and BMGT 451. Formerly BMGT 450. Develops skills in the use of scientific methods in the acquisition, analysis and interpretation of marketing data. It covers the specialized fields of marketing research; the planning of survey projects, sample design, tabulation procedure and report preparation.

BMGT 453 Industrial Marketing (3)
Prerequisites: BMGT 350 plus one other marketing course. The industrial and business sector of the marketing system is considered rather than the household or ultimate consumer sector. Industrial products range from raw materials and supplies to the major equipment in a plant, business office, or institution. Topics include product planning and introduction, market analysis and forecasting, channels, pricing, field sales force management, advertising, marketing cost analysis, and government relations. Particular attention is given to industrial, business and institutional buying policies and practice and to the analysis of buyer behavior.

BMGT 454 International Marketing (3)
Prerequisites: BMGT 350 plus one other marketing course. Marketing functions from the international executive's viewpoint, including coverage of international marketing policies relating to

product adaptation, data collection and analysis, channels of distribution, pricing, communications, and cost analysis. Consideration is given to the cultural, legal, financial, and organizational aspects of international marketing.

BMGT 455 Sales Management (3)
Prerequisite: BMGT 350. The role of the sales manager, both at headquarters and in the field, in the management of people, resources and marketing functions. An analysis of the problems involved in sales organization, forecasting, planning, communicating, evaluating and controlling. The application of quantitative techniques and pertinent behavioral science concepts in the management of the sales effort and sales force.

BMGT 456 Advertising (3)
Prerequisite: BMGT 350. The role of advertising in the American economy; the impact of advertising on our economic and social life, the methods and techniques currently applied by advertising practitioners; the role of the newspaper, magazine, and other media in the development of an advertising campaign, modern research methods to improve the effectiveness of advertising and the organization of the advertising business.

BMGT 457 Marketing Policies and Strategies (3)
Prerequisite: BMGT 452. Integrative decision making in marketing. Emphasis on consumer and market analysis and the appropriate decision models. Case studies are included.

BMGT 460 Personnel Management: Analysis and Problems (3)
Prerequisite: BMGT 360. Recommended: BMGT 230. Research findings, special readings, case analysis, simulation, and field investigations are used to develop a better understanding of personnel problems, alternative solutions and their practical ramifications.

BMGT 461 Entrepreneurship (3)
Process of creating new ventures, including evaluating the entrepreneurial team, the opportunity and the financing requirements. Skills, concepts, mental attitudes and knowledge relevant for starting a new business.

BMGT 462 Labor Legislation (3)
Case method analysis of the modern law of industrial relations. Cases include the decisions of administrative agencies, courts and arbitration tribunals.

BMGT 463 Public Sector Labor Relations (3)
Prerequisite: BMGT 362; or permission of department. Development and structure of labor relations in public sector employment; federal, state, and local government responses to unionization and collective bargaining.

BMGT 464 Organizational Behavior (3)
Prerequisite: BMGT 364. An examination of research and theory concerning the forces which contribute to the behavior of organizational members. Topics covered include: work group behavior, supervisory behavior, intergroup relations, employee goals and attitudes, communication problems, organizational change, and organizational goals and design.

BMGT 467 Undergraduate Seminar in Personnel Management (3)
Prerequisite: permission of department. This course is open only to the top one-third of undergraduate majors in personnel and labor relations and is offered during the fall semester of each year. Highlights major developments. Guest lecturers make periodic presentations.

BMGT 470 Carrier Management (3)
Prerequisites: BMGT 370; and BMGT 372. Integration of the functions available to managers in transportation companies including planning, directing and implemention of policies. Emphasis on the changing environment in which managers of transportation carriers function.

BMGT 473 Advanced Transportation Problems (3)
Prerequisite: BMGT 370. A critical examination of current government transportation policy and proposed solutions. Urban and intercity managerial transport problems are also considered.

BMGT 474 Urban Transport and Urban Development (3)
Prerequisite: ECON 203; or ECON 205. An analysis of the role of urban transportation in present and future urban development. The interaction of transport pricing and service, urban planning, institutional restraints, and public land uses is studied.

BMGT 475 Advanced Logistics Management (3)
Prerequisites: BMGT 370; and BMGT 372. Application of the concepts of BMGT 372 to problem solving and special projects in logistics management. Case analysis is stressed.

BMGT 476 Applied Computer Models in Transportation and Logistics (3)
Prerequisites: BMGT 370; and BMGT 372. Introduction to the expanding base of computer software in the transportation and logistics fields. Applications of particular relevance to carrier and shipper issues in a deregulated environment.

BMGT 477 International Transportation and Logistics (3)
Prerequisites: BMGT 370; and BMGT 372. Analysis of the structure, service, pricing and competitive relationship of U.S. international carriers and transport intermediaries. Examination of the role of foreign competitors, managerial and economic factors and politically imposed restrictions. Business and public policy implications of transportation in developing countries and their interface with international trade and development.

BMGT 480 Legal Environment of Business (3)
Junior standing. Principal ideas in law stressing those relevant for the modern business executive with focus on legal reasoning as it has evolved in this country. Leading antitrust cases illustrating the reasoning process as well as the interplay of business, philosophy, and the various conceptions of the nature of law which give direction to the process. Examination of contemporary legal problems and proposed solutions, especially those most likely to affect the business community.

BMGT 481 Public Utilities (3)
Prerequisite: ECON 203; or ECON 205. Using the regulated industries as specific examples, attention is focused on broad and general problems in such diverse fields as constitutional law, administrative law, public administration, government control of business, advanced economic theory, accounting, valuation and depreciation, taxation, finance, engineering, and management.

BMGT 482 Business and Government (3)
Prerequisite: ECON 203; or ECON 205. A study of the role of government in modern economic life. Social control of business as a remedy for the abuses of business enterprise arising from the decline of competition. Criteria of limitations on government regulation of private enterprise.

BMGT 485 Advanced Production Management (3)
Prerequisite: BMGT 385. A study of typical problems encountered by the factory manager. The objective is to develop the ability to analyze and solve problems in management control of production and in the formulation of production policies. Among the topics covered are plant location, production planning and control, methods analysis, and time study.

BMGT 490 Urban Land Management (3)
Covers the managerial and decision making aspects of urban land and property. Included are such subjects as land use and valuation matters.

BMGT 493 Honors Study (3)
Prerequisite: permission of department. First semester of the senior year. The course is designed for honors students who have elected to conduct intensive study (independent or group). The student will work under the direct guidance of a faculty advisor and the Director of Undergraduate Studies. They shall determine that the area of study is of a scope and intensity deserving of a candidate's attention. Formal written and/or oral reports on the study may be required by the faculty advisor.

BMGT 494 Honors Study (3)
Prerequisite: BMGT 493, and continued candidacy for honors in Business and Management. Second semester of the senior year. The student shall continue and complete the research initiated in BMGT 493, additional reports may be required at the discretion of the faculty advisor and Director of Undergraduate Studies.

BMGT 495 Business Policies (3)
Prerequisites: BMGT 340; and BMGT 350; and BMGT 364. A case study course where students apply what they have learned of general management principles and their specialized functional applications to the overall management function in the enterprise.

BMGT 496 Business and Society (3)
Prerequisite: one course in BMGT; or permission of department. Normative role of business in society; consideration of the sometimes conflicting interests and claims on the firm and its objectives.

BMGT 498 Special Topics in Business and Management (3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs. Special topics in business and management designed to meet the changing needs and interests of students and faculty.

BMGT 501 Business Functions (4)
Intensive review of marketing and finance functions in the business enterprise. Credit not applicable to graduate degrees.

BMGT 505 Organizational Behavior and Strategic Management (3)
Intensive review of organizational behavior theory, and administrative processes and policy in the business enterprise. Credit not applicable to graduate degrees.

BMGT 610 Financial Accounting (3)
Intensive review of the technical and conceptual aspects of financial accounting and accounting information systems as they apply to the business enterprise.

BMGT 611 Managerial Accounting I (3)
Prerequisite: BMGT 610. The use of accounting data for corporate financial planning and control. Organization for control, profit planning, budgeting, relevant costing, return on investment, and administration of the controllership function in smaller organizations.

BMGT 620 Management Information Systems (3)
The concepts, theory and techniques of information systems. The system life cycle. The role of information systems in the management and control of the organization. Effectiveness measures of information systems. Case studies of information systems as developed by industry and government. Societal impact.

BMGT 630 Managerial Statistics I (3)
Application of statistical concepts to solution of business problems; laboratory use of computer packages.

BMGT 631 Operations Research and Management (3)
Prerequisite: BMGT 630. Application of operations research and operations management concepts to solution of business problems. Emphasis on integrated approach to management decision making.

BMGT 640 Financial Management (3)
Prerequisites: BMGT 610; and BMGT 630. The role of financial management in the firm. Valuation and leverage, capital budgeting, cost of capital, dividend policy, long-term financing, working capital management, short-term financing, intermediate-term financing and leasing, mergers and international financial management topics.

BMGT 650 Marketing Management (3)
Analysis of marketing problems and evaluation of specific marketing efforts regarding the organization's products and services, pricing activities, channel selection, and promotion strategies in both domestic and international markets.

BMGT 660 Management and Organizational Behavior (3)
The influence of the behavioral sciences on the theory and practice of management. Motivation, leadership, and international styles of management.

BMGT 661 Human Resources Management (3)
The human resource function in organizations. Human resource planning, procurement and selection, training and development, performance appraisal, wage and salary administration, and equal employment opportunity.

BMGT 670 Economic Environment (3)
The macroeconomic environment and its impact on the business enterprise. Nature of economic fluctuations, analysis of consumer spending, theory and analysis of investment spending, supply and demand for money and capital, modern macroeconomic theory, international problems, forecasting and an analysis of economic conditions.

BMGT 671 Managerial Economics (3)
The application of economic theory to the business enterprise in respect to the determination of policy and the handling of management problems with particular reference to the firm producing a complex line of products, nature of competition, pricing policy, interrelationship of production and marketing problems, basic types of cost, control systems, theories of depreciation and investment and the impact of each upon costs.

BMGT 672 Physical Distribution Management (3)
Managerial practices required to fulfil the physical movement needs of extractive, manufacturing, and merchandising firms. The total cost approach to physical distribution. Interrelations among purchased transport services, privately-supplied transport services, warehousing, inventory control, materials handling, packaging, and plant location. The communications network to support physical distribution. The problems of coordination between the physical movement management function and other functional areas within the business firm, such as accounting, finance, marketing, and production.

BMGT 680 Business and Public Policy (3)
Prerequisite: BMGT 670. Survey of conceptual and legal aspects of the business-environment relationship; nature of public policy; major historic and current policy issues; business role in the policy process; developing and managing corporate social policy and impact; special problems of the multinational corporation.

BMGT 690 Strategic Management (3)
Prerequisites: permission of department; and completion of all other MBA core courses before registering for this course. Case studies and research in the identification of management problems, the evaluation of alternative solutions, and the recommendation for management implementation.

BMGT 702 Applied Security Analysis and Portfolio Management (3)
Prerequisites: BMGT 640; and BMGT 743; and permission of department. Applications in definition of investment objectives, security analysis, portfolio analysis, portfolio selection, and portfolio management as they relate to the MBA Educational Investment Fund. Emphasis on analysis and recommendations.

BMGT 710 Advanced Accounting Theory (3)
Prerequisite: BMGT 610. Contemporary issues in financial accounting. The nature of income, the relationship between asset valuation and income determination, and various approaches to

accounting for inflation. The accounting standards setting process. The measurement and valuation of assets (e.g., foreign investments) and liabilities (e.g., leases and pensions).

BMGT 711 Advanced Managerial Accounting (3)
Prerequisites: permission of department; and completion of all first year MBA courses before registering for this course. Study of advanced topics such as residual income, transfer pricing, information inductance, break-even analysis under uncertainty, statistical significance of standard cost variance, cost analysis and pricing decisions, distribution cost accounting, accounting data and managerial incentive contracts, and decision support systems for capital budgeting.

BMGT 712 Accounting in Regulated Industries (3)
Prerequisite: BMGT 611. Study of the unique accounting problems of industrial regulation by governmental agencies.

BMGT 713 The Impact of Taxation On Business Decisions (3)
Prerequisite: BMGT 611. The impact of tax law and regulations on alternative strategies with particular emphasis on the large, multidivisional firm. Problems of acquisitions, mergers, spinoffs, and other divestitures from the viewpoint of profit planning, cash flow, and tax deferment.

BMGT 715 International Accounting (3)
Prerequisite: BMGT 611. International accounting, its problems and organization with the study of the issues involved; international standards of accounting and auditing; national differences in accounting thought and practice.

BMGT 721 File Processing and Database Systems (3)
Prerequisite: permission of department. Concepts and techniques for structuring data on secondary storage devices. Experience in the use of these techniques. The basic data structures necessary for these techniques. Typical file processing applications.

BMGT 724 Economics of Information Systems (3)
Prerequisite: BMGT 620; or BMGT 721. Methods for the economic construction and operation of computer systems. Techniques for sizing and costing system components and for optimizing system design. Methods for efficient utilization of computer resources with particular consideration of relevant economic topics such as transfer pricing, joint costs, peak load pricing problems and public goods problems.

BMGT 725 Information Systems Analysis and Design (3)
Prerequisite: BMGT 620; or BMGT 721. Introduction to practical techniques for information systems and design. Design requirements for information processing systems. Models and tools for requirement analysis. Case studies for actual systems and applications.

BMGT 726 Distributed Data Processing (3)
Prerequisite: BMGT 620; or BMGT 721. Introduction to distributed data processing concepts. The building blocks of distributed systems: computers, terminals, and communications; the interface and protocols that allow them to function as an integrated system. Major categories of distributed systems; resource-sharing networks, multiple-processor networks, and tightly coupled multiprocessors.

BMGT 727 Security and Control of Information Systems (3)
Prerequisite: BMGT 620; or BMGT 721. The information control risks faced by corporations. Techniques for enhancing the security and integrity of corporate information resources. The auditing and control procedures for corporate information systems. Actual case studies.

BMGT 731 Theory of Survey Design (3)
Prerequisite: BMGT 630. The usefulness of statistical principles in survey design. The nature of statistical estimation, the differential attributes of different estimators, the merits and weaknesses of available sampling methods and designs, the distinctive aspects of simple random samples,

stratified random samples, and cluster samples, ratio estimates and the problems posed by biases and non-sampling errors.

BMGT 733 Managerial Statistics II (3)
Prerequisite: BMGT 630 or equivalent. Covers simple and multiple regression, including polynomial regression, residual analysis, multicollinearity, autocorrelation, model selection techniques, analysis of variance and experimental design.

BMGT 735 Application of Management Science (3)
Prerequisite: BMGT 631. Selected topics and case studies in the application of management science to decision making in various functional fields.

BMGT 736 Philosophy and Practice of Management Science (3)
Prerequisites: BMGT 630; and BMGT 632. Critical examination of the philosophy underlining the techniques and methodology of management science from a systems analysis point of view.

BMGT 737 Management Simulation (3)
Prerequisite: BMGT 631. Methodology of systems simulation, Monte Carlo simulation, and discrete simulation. Verification and validation of simulation models with computer applications.

BMGT 740 New Venture Financing (3)
Prerequisite: BMGT 640 or permission of department. Development of skills for financing new ventures (both small and potentially large). Exploration of various funding sources. Criteria used in evaluation and decision process, including commercial banks, venture capital companies, small business investment companies, underwriters, private placement-financial consultants, mortgage bankers, and small business innovative research grants (U.S. Government). Topics will include: methods of financing, techniques for valuing new businesses, financial structure, and evaluation methods used by investors and lenders.

BMGT 741 Advanced Financial Management (3)
Prerequisite: BMGT 640. Concepts underlying financial decision making in the firm. Case studies, model building and applications in financial theory and management.

BMGT 742 Financial Planning and Strategy (3)
Prerequisite: BMGT 640. Integration and extension of financial theory to financial planning and strategy. Financial decision making through case analysis and financial planning models.

BMGT 743 Investment Management (3)
Prerequisite: BMGT 640. Methods of security selection and portfolio management in the debt and equity markets. Investment alternatives, securities markets, bond and common stock valuation, options, portfolio theory, and behavior of stock prices.

BMGT 744 Futures Contracts and Options Management (3)
Prerequisites: BMGT 640. The institutional features and economic rationale underlying markets in futures and options. Hedging, speculation, structure of futures prices, interest rate futures, efficiency in futures markets, and stock and commodity options. Current journal literature.

BMGT 745 Financial Institutions Management (3)
Prerequisite: BMGT 640. The role of financial management in financial institutions. The economic role and regulation of financial institutions, analysis of risks and returns on financial assets and liabilities, and the structure of assets, liabilities and capital.

BMGT 746 International Financial Management (3)
Prerequisite: BMGT 640. The role of financial management in the multinational firm. The financing and managing of foreign investments, assets, currencies, imports and exports. National and international financial institutions and markets.

BMGT 751 Marketing Communications Management (3)
Prerequisite: BMGT 650. The role of advertising, promotion, public relations and related efforts in the accomplishment of a firm's total marketing objectives. The development of competence

in the formulation of mass communications, objectives in budget optimization, media appraisal, theme selection, program implementation and management, and results measurement.

BMGT 752 Marketing Research Methods (3)
Prerequisites: BMGT 630; and BMGT 650. The process of acquiring, classifying and interpreting primary and secondary marketing data needed for intelligent, profitable marketing decisions. Evaluation of the appropriateness of alternative methodologies such as the inductive, deductive, survey, observational, and experimental. Recent developments in the systematic recording and use of internal and external data needed for marketing decisions.

BMGT 753 International Marketing (3)
Prerequisite: BMGT 650. Environmental, organizational, and financial aspects of international marketing as well as problems of marketing research, pricing, channels of distribution, product policy, and communications which face U.S. firms trading with foreign firms or which face foreign firms in their operations.

BMGT 754 Buyer Behavior Analysis (3)
Prerequisite: BMGT 650. A systematic examination and evaluation of the literature, research tradition and theory of buyer behavior in the market place from a fundamental and applied perspective. The cognitive and behavioral bases underlying the buying process of individuals and institutions.

BMGT 756 Business-to-Business Marketing (3)
Prerequisite: BMGT 650. Problems and processes in marketing to organizational customers rather than final consumers. Basic marketing strategies and behavioral models adjusted to accommodate the unique requirements of marketing to business and governmental customers.

BMGT 761 Problems and Applications in Personnel Administration (3)
Prerequisite: BMGT 661. Applications in the design, implementation, and evaluation of human resource management programs. Experiential learning activities and simulations.

BMGT 762 Problems and Issues in Collective Bargaining (3)
Current problems and issues in collective bargaining, including methods of handling industrial disputes, legal restrictions on various collective bargaining activities, theory and philosophy of collective bargaining, and internal union problems.

BMGT 763 Administration of Labor Relations (3)
Analysis of labor relations at the plant level with emphasis on the negotiation and administration of labor contracts. Union policy and influence on personnel management activities.

BMGT 765 Application of Behaviorial Science to Business (3)
Prerequisite: BMGT 660. Case analysis of behavioral knowledge applied to management problems. Analysis of modes for introducing change, group versus organizational goals, organizational barriers to personal growth, the effect of authority systems on behavior, and the relationship between technology and social structure.

BMGT 766 Management Planning and Control Systems (3)
Prerequisite: BMGT 660. Analysis of planning and control systems as they relate to the fulfillment of organizational objectives. Identification of organizational objectives, responsibility centers, information needs, and information networks. Case studies of integrated planning and control systems.

BMGT 767 Implementing Strategy: Organizing to Compete (3)
Prerequisite: completion of the MBA core requirements or permission of department. Recommended: BMGT 690. Organizational dynamics of competitive advantage. Impact of alternative organizational structures, planning and control systems, human resource management practices, and executive leadership styles on the implementation of archetypically different strategies.

BMGT 770 Transportation Theory and Analysis (3)
Prerequisite: BMGT 672. The transportation system and its components. The development and present form of transportation in both the United States and other countries. Theoretical concepts employed in the analysis of transport problems.

BMGT 771 Transportation and Public Policy (3)
Prerequisite: BMGT 672. The nature and consequences of relations between governments and agencies thereof, carriers in the various modes, and users of transport. The control of transport firms by regulatory bodies, taxation of carriers, methods employed in the allocation of funds to the construction, operation, and maintenance of publicly-provided transport facilities, and the direct subsidization of services supplied by privately-owned entities. Labor and safety. Comparative international transport policies and problems.

BMGT 773 Transportation Strategies (3)
Prerequisite: BMGT 672. Organization structure, policies, and procedures employed in the administration of inter- and intraurban transport firms. Managerial development, operational and financial planning and control, demand analysis, pricing, promotional policies, intraand intermodal competitive and complementary relationships, and methods for accommodating public policies designed to delimit the managerial discretion of carrier executives. Administrative problems peculiar to publicly-owned and operated transport entities.

BMGT 776 Management of High Technology, Research and Development (3)
The creation of competitive advantages through the use of new technology. The integration of technological strategy with business strategy within the internal corporate culture. Research and development in the context of this strategy-structure of the firm. The nature of R & D, the management of creativity, and new product development are also discussed.

BMGT 777 Policy Issues in Public Utilities: Energy and the Environment (3)
Prerequisite: BMGT 671. Current developments in regulatory policy and issues arising among public utilities, regulatory agencies, and the general public. Emphasis on the electric, gas, water, and communications industries in both the public and private sectors of the economy. Changing and emerging problems such as cost analysis, depreciation, finance, taxes, rate of return, the rate base, differential rate-making, and labor. The growing importance of technological developments and their impact on state and federal regulatory agencies.

BMGT 780 New Venture Creation (3)
Prerequisite: completion of MBA core requirements or permission of department. Creating new ventures, including evaluating the entrepreneurial team, the opportunity and financing requirements. Skills, concepts, attitudes and know-how relevant for creating and building a venture; and preparation of a business plan. These approaches are not limited to new or growing enterprises.

BMGT 781 The Entrepreneur and the Entrepreneurial Team (3)
Prerequisite: completion of MBA core requirements or permission of department. The entrepreneur and the entrepreneurial team: the entrepreneur and the team as it relates to innovation, change, power, and risk-taking. Entrepreneurs and their teams from a variety of different firms present and discuss their views on leadership.

BMGT 782 Corporate Venturing and Intrepreneurship (3)
Prerequisite: completion of MBA core or permission of department. Corporate venturing and intrepreneurship: overview of the venture process in corporations and the unique problems and opportunities for corporate entrepreneurs in the venturing process to reduce the cost of failure and increasing the chance of success. Emphasis is on the internal corporate venturing process, from selection to new venture creation.

BMGT 791 MBA Field Project (3)
Prerequisite: permission of department. Experiental research project in the identification of management problems, the evaluation of alternative solutions, and the recommendation for management.

BMGT 794 The Environment of International Business (3)
The international business environment as it affects company policy and procedures. In-depth analysis and comprehensive case studies of the business functions undertaken in international operations.

BMGT 795 Management of the Multinational Firm (3)
The problems and policies of international business enterprise at the management level. Management of a multinational enterprise as well as management within foreign units. The multinational firm as a socio-econometric institution. Cases in comparative management.

BMGT 798 Special Topics in Business and Management (3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs. Selected advanced topics in the various fields of graduate study in business and management.

BMGT 799 Master's Thesis Research (1-6)

BMGT 808 Doctoral Seminar (3)
Prerequisite: admission to the D.B.A. Program or permission of department. Repeatable if content differs. Selected advanced topics in the various fields of doctoral study in business and management.

BMGT 811 Seminar in Accounting Theory (3)
Prerequisite: BMGT 710 or equivalent. Seminar in the continuing development of the fundamental theoretical framework of accounting.

BMGT 814 Current Problems of Professional Practice (3)
Generally accepted auditing standards, auditing practices, legal and ethical responsibilities, and the accounting and reporting requirements of the securities and exchange commission.

BMGT 821 Seminar in Management Accounting (3)
Prerequisite: BMGT 711 or equivalent. Design and use of accounting information systems for managerial planning and controllership.

BMGT 823 Data Base Design (3)
Prerequisite: BMGT 721. The problem of database design in the development of information systems. An integrated database design methodology. Techniques for different phases of database design. Computer-aided tools for data base design.

BMGT 824 Database Systems Architecture (3)
Prerequisite: BMGT 721. The important design issues in the software architecture of a database management system. Group projects for the purpose of designing and implementing subsystems of a simple relational database system. Database types and applications.

BMGT 825 Knowledge-Based Systems (3)
Prerequisite: BMGT 721. For BMGT majors only. Use of artificial intelligence techniques in developing knowledge-based systems in Management Information Systems and Decision Support Systems. Knowledge representation formalisms, inference and control mechanisms for data intensive applications, object-oriented systems, expert database systems, intelligent user interfaces for DSS, and special problems (eg. plausible reasoning, non-monotonic reasoning, heterogeneous knowledge bases and explanation support).

BMGT 828 Independent Study in Business and Management (1-9)

BMGT 830 Operations Research: Linear Programming (3)
Prerequisites: MATH 240 or equivalent; or permission of department. Concepts and applications of linear programming models, theoretical development of the simplex algorithm, and primal-dual problems and theory.

BMGT 831 Operations Research: Extension of Linear Programming and Network Analysis (3)
Prerequisite: BMGT 830 or equivalent; or permission of department. Concepts and applications of network and graph theory in linear and combinatorial models with emphasis on computational algorithms.

BMGT 832 Operations Research: Optimization and Nonlinear Programming (3)
Prerequisites: [BMGT 830; and MATH 241; or equivalent]; or permission of department. Theory and applications of algorithmic approaches to solving unconstrained and constrained non-linear optimization problems. The Kuhn Tucker conditions, Lagrangian and Duality Theory, types of convexity, and convergence criteria. Feasible direction procedures, penalty and barrier techniques, and cutting plane procedures.

BMGT 833 Operations Research: Integer Programming (3)
Prerequisites: [BMGT 830; and MATH 241 or equivalent]; or permission of department. Theory, applications, and computational methods of integer optimization. Zero-one implicit enumeration, branch and bound methods, and cutting plane methods.

BMGT 834 Operations Research: Probabilistic Models (3)
Prerequisites: [MATH 241; and STAT 400 or equivalent] or permission of department. Theoretical foundations for the construction, optimization, and applications of probabilistic models. Queuing theory, inventory theory, Markov processes, renewal theory, and stochastic linear programming.

BMGT 835 Simulation and Design of Experiments (3)
Prerequisites: knowledge of Fortran programming; [BMGT 630; and BMGT 631 or equivalent] or permission of department. Statistical design and analysis of simulation experiments.

BMGT 840 Seminar in Financial Theory (3)
Prerequisite: permission of department. Seminar in selected classic and current theoretical and empirical research in the foundations of finance.

BMGT 841 Seminar in Corporate Finance (3)
Prerequisite: permission of department. Seminar in selected classic and current theoretical and empirical research in corporate finance.

BMGT 843 Seminar in Portfolio Theory (3)
Prerequisite: permission of department. Seminar in selected classic and current theoretical and empirical research in portfolio theory.

BMGT 845 Seminar in Financial Institutions and Markets (3)
Prerequisite: permission of department. Seminar in selected classic and current theoretical and empirical research in financial institutions and markets.

BMGT 850 Marketing Channels Analysis (3)
Prerequisites: permission of department. MBA candidates only. Focuses on the fundamental alternative channels of distribution, the roles played by various intermediaries, evolution of business structures in marketing, reasons for change, and projected marketing scenarios.

BMGT 851 Quantitative Methods in Marketing: Demand and Cost Analysis (3)
Quantitative methods in the analysis and prediction of market demand and marketing costs. Demand related topics include estimating market potential, sales forecasting methods, buyer analysis, promotional and pricing impacts, and related issues. Cost analysis focuses on allocation of costs by marketing functions, products, territories, customers and marketing personnel. Statistical techniques, models and other quantitative methods are utilized to solve various marketing problems. M.B.A. candidates may register with permission of department.

BMGT 852 Theory in Marketing (3)
An inquiry into the problems and elements of theory development in general with specific reference to the field of marketing. A critical analysis and evaluation of past and contemporary efforts to formulate theories of marketing and to integrate theories from the social sciences into

a marketing framework. Attention is given to the development of concepts in all areas of marketing thought and to their potential application in the business firm.

BMGT 860 Seminar in Human Resource Planning and Selection (3)
Prerequisite: BMGT 760 or permission of department. Seminar in selected theoretical and empirical literature in human resource planning, forecasting, and staffing.

BMGT 861 Seminar in Performance Appraisal and Training (3)
Prerequisite: BMGT 760 or permission of department. Seminar in selected theoretical and empirical literature in performance appraisal and training.

BMGT 862 Seminar in Compensation Administration (3)
Prerequisite: BMGT 760 or permission of department. Seminar in selected theoretical and empirical literature in the compensation of human resources.

BMGT 863 Seminar: The Organization and the Individual (3)
Prerequisite: BMGT 764 or equivalent; or permission of department. Seminar in the literature on the relationship between individual and organizational characteristics, with emphasis on work motivation theories.

BMGT 864 Seminar in Interpersonal Relations and the Group Process in Organization (3)
Prerequisite: BMGT 764 or equivalent; or permission of department. Examines the literature of small group behavior relevant to industrial work groups, white-collar work groups, professional staff, and managerial units. Includes group structure and process variables, as well as the leadership function.

BMGT 865 Seminar in Comparative Theories of Organization (3)
Prerequisite: BMGT 764 or equivalent; or permission of department. Emphasis on the interdisciplinary literature on classical management, systems, and contingency theories of organization.

BMGT 866 Seminar in Organizational Conflict and Change (3)
Prerequisite: BMGT 764 or equivalent; or permission of department. Emphasis on the introduction of planned and systematic changes in small work groups, organizational subsystems, and the entire organization through the use of behavioral science techniques and theories of intra- and inter-group conflict.

BMGT 872 Business Logistics (3)
Concentrates on the design and application of methods for the solution of advanced physical movement problems of business firms. Provides thorough coverage of a variety of analytical techniques relevant to the solution of these problems. Where appropriate, experience will be provided in the utilization of computers to assist in managerial logistical decision-making.

BMGT 873 Transportation Science (3)
Focuses on the application of quantitative and qualitative techniques of analysis to managerial problems drawn from firms in each of the various modes of transport. Included is the application of simulation to areas such as the control of equipment selection and terminal and line operations. The application of advanced analytical techniques to problems involving resource use efficiency within the transportation industry and between transportation and other sectors of the economy is an integral part of the course.

BMGT 880 Business Research Methodology (3)
Covers the nature, scope, and application of research methodology. The identification and formulation of research designs applicable to business and related fields. Required of D.B.A. students.

BMGT 882 Applied Multivariate Analysis I (3)
Prerequisite: BMGT 733 or equivalent. Topics include elementary properties of matrices, multivariate distributions, the multivariate linear model, path analysis. The examination of business data using existing computer programs is an integral part of the course.

BMGT 883 Applied Multivariate Analysis II (3)
Prerequisite: BMGT 882. Topics include discriminant analysis, cluster analysis, principal component analysis, canonical analysis, factor analysis and other current multivariate statistical methods.

BMGT 884 Univariate Forecasting Models (3)
Prerequisite: BMGT 630 or equivalent. Traditional approaches to forecasting such as trend models and smoothing techniques. Models for stationary and nonstationary time series, their identification, estimation, forecasts and use in a business environment. All students are required to do a project utilizing these models in the analysis of business data.

BMGT 885 Multiple Time Series Model Building (3)
Prerequisite: BMGT 884. Recommended: BMGT 882. Identification, estimation, and forecasting of dynamic systems, the application of intervention techniques to business problems, and the properties and fitting of multiple time series models to business data. All students are required to do a project using these techniques in analyzing business data.

BMGT 886 Statistical Quality Control (3)
Prerequisite: BMGT 733 or equivalent. Lot acceptance sampling plans, rectifying inspection, control charts, reliability, dependence fitting, parameter estimation, false and incomplete inspection models, and model verification based on actual data.

BMGT 887 Bayesian Inference and Decision Theory (3)
Prerequisite: BMGT 733 or equivalent. Bayesian Methodologies in statistical inference and decision theory. Includes discussion of subjective probability and coherence, elicitation of distributions conjugate distributions, estimation, testing, preposterior analysis and regression analysis. Applications are drawn from the functional business areas.

BMGT 899 Doctoral Dissertation Research (1-8)

BOTN – Botany

BOTN 401 Origins of Modern Botany (1)
Prerequisite: 20 credit hours in biological science including BIOL 105 or permission of department. History of botany as a science, from ancient Greece through the 18th century; emphasis on botany as an intellectual and cultural pursuit.

BOTN 403 Medicinal and Poisonous Plants (2)
Prerequisite: BIOL 105 and CHEM 104. A study of plants important to humans that have medicinal or poisonous properties. Emphasis on plant source, plant description, the active agent and its beneficial or detrimental physiological action and effects.

BOTN 405 Advanced Plant Taxonomy (3)
Two lectures and one laboratory per week. *Prerequisite: BOTN 202; and BOTN 212, or equivalent.* A review of the history and principles of plant taxonomy with emphasis on monographic and floristic research. A detailed laboratory review of the families of flowering plants.

BOTN 407 Teaching Methods in Botany (2)
Four two-hour laboratory demonstration periods per week, for eight weeks. *Prerequisite: BIOL 105 or permission of department.* A study of the biological principles of common plants, and demonstrations, projects, and visual aids suitable for teaching in primary and secondary schools.

BOTN 411 Evolutionary Biology of Plants (3)
Prerequisite: BOTN 202 or equivalent. Evolution of basic plant biological systems, major structural adaptations of plant organs, and origins of vascular plant groups. The pace, patterns and mechanisms of evolution, discussed within a genetic, systematic and paleontological framework.

BOTN 413 Plant Geography (2)
Prerequisite: BIOL 105. A study of plant distribution throughout the world and the factors generally associated with such distribution.

BOTN 414 Plant Genetics (3)
Prerequisite: BIOL 105. Credit will be granted for only one of the following: ZOOL 213, ANSC 201, BOTN 414, HORT 274. The basic principles of plant genetics are presented; the mechanics of transmission of the hereditary factors in relation to the life cycle of seed plants, the genetics of specialized organs and tissues, spontaneous and induced mutations of basic and economic significance gene action, genetic maps, the fundamentals of polyploidy, and genetics in relation to methods of plant breeding.

BOTN 416 Plant Structure (4)
Two hours of lecture and four hours of laboratory per week. *Prerequisite: BIOL 105.* A survey of the basic structural features of vascular plants, including subcellular organelles, cells, tissues, and organs. Emphasis on structural phenomena as they relate to physiological processes of agricultural importance.

BOTN 420 Plant Cell Biology (3)
Prerequisite: organic chemistry and two years of botany. A study of eucaryotic cell organization, integrating structure with function and concentrating on subcellular organelles and the mechanisms of physiological regulation at the cellular level.

BOTN 421 Principles of Plant Disease Management (3)
Two hours of lecture and two hours of laboratory per week. *Prerequisite: BOTN 221 or equivalent.* A logical, holistic approach to understanding and planning disease control using multiple strategies and tactics to prevent crop losses from exceeding economic damage levels.

BOTN 426 Mycology (4)
Two hours of lecture and six hours of laboratory per week. *Prerequisite: BIOL 105.* An introductory course in the biology, morphology and taxonomy of the fungi.

BOTN 441 Plant Physiology (4)
Two hours of lecture and four hours of laboratory per week. *Prerequisites: BIOL 105; and CHEM 113. Recommended: Organic chemistry.* A survey of the general physiological activities of plants.

BOTN 456 Principles of Microscopy (2)
Prerequisite: BOTN 420 or equivalent. An introduction to optical principles that underlie light and electron microscopic image formation. Brightfield, darkfield, phase contrast, differential interference contrast, fluorescence and polarized light microscopy. Comparison of light and electron microscopy. The application of these techniques to problems in biological research.

BOTN 462 Plant Ecology (2)
Prerequisite: BIOL 105. The dynamics of populations as affected by environmental factors with special emphasis on the structure and composition of natural plant communities, both terrestial and aquatic.

BOTN 463 Ecology of Marsh and Dune Vegetation (2)
Prerequisite: BIOL 105. An examination of the biology of higher plants in dune and marsh ecosystems.

BOTN 464 Plant Ecology Laboratory (2)
Three hours of laboratory per week. *Pre- or corequisite: BOTN 462 or equivalent.* Two or three field trips per semester. The application of field and experimental methods to the qualitative and quantitative study of vegatation and ecosystems.

BOTN 476 Biology of Phytoplankton (4)
Two hours of lecture and four hours of laboratory per week. *Prerequisites: BIOL 105 and an introductory course in ecology (ZOOL 212 or equivalent).* Collection, identification, culture, physical and chemical requirements, life cycles, community structure, specialized environments, blooms of phytoplankton.

BOTN 484 Plant Biochemistry (3)
Prerequisite: BOTN 441; and CHEM 233. Biochemical processes characteristic of plants, including photosysnthesis, nitrogen fixation and biosynthesis of plant macromolecules.

BOTN 620 Methods in Plant Tissue Culture (2)
One lecture and one two-hour laboratory period a week. *Prerequisite: permission of both department and instructor.* A methodology and techniques course designed to give the student background and experience in plant tissue culture.

BOTN 621 Physiology of Fungi (2)
Prerequisite: CHEM 243; and BOTN 441 or equivalent in bacterial or animal physiology. A study of various aspects of fungal metabolism, nutrition, biochemical transformation, fungal products, and mechanism of fungicidal action.

BOTN 623 Physiology of Fungi Laboratory (1)
Two hours of laboratory per week. *Pre- or corequisite: BOTN 621.* Application of equipment and techniques in the study of fungal physiology.

BOTN 624 Prokaryotic Plant Pathogens (2)
Two hours of lecture and one hour of discussion/recitation per week. *Prerequisite: BOTN 221 and permission of both department and instructor.* A study of plant-pathogenic prokaryotes with emphasis on systematics, etiology, cytological and physiological characteristics of the plant-pathogen interaction, ecology, epidemiology, control, and genetics.

BOTN 625 Prokaryotic Plant Pathogens Laboratory (2)
One four-hour laboratory and discussion period per week. *Pre- or corequisite: BOTN 221; and BOTN 624; and permission of both department and instructor.* Emphasis on techniques and methods applicable to clinical studies and research on prokaryotic plant pathogens.

BOTN 632 Plant Virology (2)
Prerequisite: permission of both department and instructor. Second semester. Biological, biochemical, and biophysical aspects of viruses and viral diseases of plants.

BOTN 634 Plant Virology Laboratory (2)
Prerequisites: bachelor's degree in any biological science or equivalent and permission of both department and instructor. Pre- or corequisite: BOTN 632. Second semester. Two laboratories per week on the application and techniques for studying the biological, biochemical and biophysical aspects of plant viruses.

BOTN 636 Plant Nematology (4)
Two lectures and two laboratory periods a week. *Prerequisite: BOTN 221 or permission of both department and instructor.* The study of plant-parasitic nematodes, their morphology, anatomy, taxonomy, genetics, physiology, ecology, host-parasite relations and control. Emphasis on recent advances.

BOTN 640 Molecular Mechanisms of Plant Pathogenesis (2)
Prerequisite: BOTN 461. Evaluation of current evidence on the role in plant disease development of various molecules produced by hosts and parasites. Examination of the molecular basis of microbial pathogenicity and plant disease resistance.

BOTN 645 Growth and Development (2)
Prerequisite: BOTN 441. Physiology of plant hormones, control of morphogenesis and regulation of biosynthesis, photomorphogenesis and photoperiodism.

BOTN 646 Plant Morphogenesis (2)
Prerequisite: BOTN 416 or equivalent. Biophysical aspects of plant development with particular focus on such structural phenomena as molecular self-assembly, polarity, cell division, cell expansion, meristem organization, phyllotaxis, and organ formation.

BOTN 650 Nutrition and Transport in Plants (2)
Prerequisite: BOTN 441. The uptake, partioning and utilization of the materials of the plant body. Transport of ions across cell membranes, fixation and metabolism of carbon and nitrogen, and long distance transport of inorganic chemicals and photosynthates in vascular plants. Special emphasis on control and regulatory mechanisms that are unique to plant systems.

BOTN 662 Physiological Plant Ecology (2)
Prerequisite: BOTN 462 or equivalent. Environmental effects on plant ecophysiology. Microclimatology, leaf energy balance, plant responses to temperature and radiation, physiological adaptions, water relations, plant gas exchange and resistance.

BOTN 684 Plant Membrane Physiology (2)
Prerequisite: BOTN 441; and BOTN 484 or equivalent. Biochemical and biophysical approaches to plant membrane structure and function.

BOTN 685 Advanced Plant Physiology Laboratory (2)
One lecture and one four-hour laboratory period a week. *Prerequisite: BOTN 441.* Biochemical and biophysical approaches to the study of the physiological processes of plants.

BOTN 686 Molecular Genetics of Plants (2)
Prerequisite: [BOTN 414; and BOTN 441; and BOTN 484] or equivalent. Current status of research on the structure, expression, and in vitro manipulation of plant nuclear genes and on the molecular genetics of plant organelles.

BOTN 689 Special Topics in Botany (1-3)
Maximum credit toward an advanced degree for the individual student with permission of department. Credit according to time scheduled and organization of course. This course is organized as lectures, discussions or literature surveys on specialized advanced topics under the direction of visiting lecturers or resident faculty.

BOTN 698 Seminar in Botany (1)
Prerequisite: permission of department. Discussion of special topics and current literature in all phases of botany.

BOTN 699 Special Problems in Botany (1-3)
Credit according to time scheduled and organization of course. Maximum credit towards an advanced degree for the individual student at the discretion of the student's advisor. This course emphasizes research on a specialized advanced topic and may consist primarily of experimental procedures under the direction of visiting lecturers or resident faculty.

BOTN 721 Clinical and Field Plant Pathology (1-2)
Diagnosis of plant diseases under clinical conditions, observation of symptoms and disease patterns in the field, collecting specimens, and writing control recommendations. Student electing one credit hour may emphasize either field or clinical aspects.

BOTN 799 Master's Thesis Research (1-6)
BOTN 899 Doctoral Dissertation Research (1-8)

CHEM – Chemistry

CHEM 401 Inorganic Chemistry (3)
Prerequisite: CHEM 481.

CHEM 403 Radiochemistry (3)
Prerequisite: one year of college chemistry and one year of college physics. Radioactive decay; introduction to properties of atomic nuclei; nuclear processes in cosmology; chemical, biomedical and environmental applications of radioactivity; nuclear processes as chemical tools; interaction of radiation with matter.

CHEM 421 Advanced Quantitative Analysis (3)
Pre- or corequisites: CHEM 482 and CHEM 483. An examination of some advanced topics in quantitative analysis including nonaqueous titrations, precipitation phenomena, complex equilibria, and the analytical chemistry of the less familiar elements.

CHEM 425 Instrumental Methods of Analysis (3)
One hour of lecture and six hours of laboratory per week. *Prerequisite: CHEM 321.* An introduction to modern instrumentation in analytical chemistry. Electronics, spectroscopy, chromatography and electrochemistry.

CHEM 433 Chemical Synthesis (3)
One hour of lecture and six hours of laboratory per week. *Prerequisite: CHEM 113 or CHEM 115; and CHEM 243 or CHEM 245.*

CHEM 441 Advanced Organic Chemistry (3)
Prerequisite: CHEM 481. An advanced study of the compounds of carbon, with special emphasis on molecular orbital theory and organic reaction mechanisms.

CHEM 443 Qualitative Organic Analysis (3)
One hour of lecture and six hours of laboratory per week. *Prerequisite: CHEM 113 or CHEM 115, and CHEM 243 or CHEM 245.* The systematic identification of organic compounds.

CHEM 473 Geochemistry of Solids (3)
Prerequisite: CHEM 482 or GEOL 422. Principles of crystal chemistry applied to structures, properties and reactions of minerals and non-metallic solids. Emphasis is placed on the relation of structural stability to bonding, ionic size, charge, order-disorder, polymorphism, and isomorphism.

CHEM 474 Environmental Chemistry (3)
Prerequisite: CHEM 481 or equivalent. The sources of various elements and chemical reactions between them in the atmosphere and hydrosphere are treated. Causes and biological effects of air and water pollution by certain elements are discussed.

CHEM 481 Physical Chemistry I (3)
Prerequisite: CHEM 113 or CHEM 115; CHEM 243 or CHEM 245; MATH 141; and PHYS 142 or PHYS 263. (PHYS 263 may be taken concurrently). A course primarily for chemists and chemical engineers.

CHEM 482 Physical Chemistry II (3)
Prerequisite: CHEM 481. A course primarily for chemists and chemical engineers.

CHEM 483 Physical Chemistry Laboratory I (2)
One hour lecture-recitation and one three-hour laboratory period per week *Corequisite: CHEM 481.* An introduction to the principles and application of quantitative techniques in physical chemical measurements. Experiments will be coordinated with topics in CHEM 481.

CHEM 484 Physical Chemistry Laboratory II (2)
One hour lecture-recitation and one three-hour laboratory period per week. *Prerequisite: CHEM 481 and CHEM 483. Corequisite: CHEM 482.* A continuation of CHEM 483. Advanced quantitative techniques necessary in physical chemical measurements. Experiments will be coordinated with topics in CHEM 482.

CHEM 485 Advanced Physical Chemistry (2)
Prerequisite: CHEM 482. Quantum chemistry and other selected topics.

CHEM 486 Advanced Physical Chemistry Laboratory (2)
Six hours of laboratory per week. *Prerequisites: CHEM 482 and permission of instructor.*

CHEM 487 Computer Applications in the Biological and Chemical Sciences (4)
Three hours of lecture, three hours of laboratory, and one hour of discussion/recitation per week. *Prerequisite: CHEM 113 and CHEM 287 or equivalent; and knowledge of a scientific*

programming language (PASCAL, FORTRAN or "C"). The utilization of computers to solve chemical and biological problems, with emphasis on the utilization of available software rather than "de novo" programming.

CHEM 498 Special Topics in Chemistry (3)
Three lectures or two lectures and one three-hour laboratory per week. *Prerequisite varies with the nature of the topic being considered. Course may be repeated for credit if the subject matter is substantially different, but not more than three credits may be accepted in satisfaction of major supporting area requirements for chemistry majors.*

CHEM 504 Fundamentals of Organic Chemistry and Biochemistry (4)
Three lectures and three hours of laboratory per week. *Prerequisite: CHEM 503 or equivalent.* A one-semester survey of organic chemistry and biochemistry. The chemistry of carbon: aliphatic compounds, aromatic compounds, stereochemistry, halides, amines, amides, acids, esters, carbohydrates, and natural products. The laboratory experiments deal with synthetic and analytical organic activities.

CHEM 513 Principles of Chemistry II (4)
Three lectures and three hours of laboratory per week. *Prerequisite: CHEM 503 or equivalent.* A continuation of the advanced survey of topics started in CHEM 503. Kinetics, thermodynamics, ionic equilibria, oxidation-reduction, electrochemistry, and the chemistry of common metals and nonmetals. Quantitative problem solving. Laboratory experiments, mostly quantitative in nature, support the topics developed in the lectures.

CHEM 521 Quantitative Analysis (4)
Two lectures and two three-hour laboratories per week. *Prerequisite: CHEM 115 or equivalent.* Volumetric, gravimetric, electrometric and colorimetric methods in analytical inorganic chemistry.

CHEM 601 Advanced Inorganic Chemistry I (3)
Prerequisite: CHEM 401 or equivalent. A survey of the fundamentals of modern inorganic chemistry as a basis for more advanced work.

CHEM 602 Advanced Inorganic Chemistry II (3)
Prerequisite: CHEM 601. A continuation of CHEM 601 with more emphasis on current work in inorganic chemistry.

CHEM 605 Chemistry of Coordination Compounds (3)
Prerequisite: CHEM 601. Structure and properties of coordination compounds and the theoretical bases on which these are interpreted.

CHEM 606 Chemistry of Organometallic Compounds (3)
Prerequisite: CHEM 601. An in-depth treatment of the properties of compounds having metal-carbon bonds.

CHEM 608 Selected Topics in Inorganic Chemistry (1-3)
Prerequisite: CHEM 601 and CHEM 602, or equivalent. Repeatable to 6 credits if content differs. Topics of special interest and current importance.

CHEM 623 Optical Methods of Quantitative Analysis (3)
Prerequisites: CHEM 421 and CHEM 482 or equivalent. The quantitative applications of various methods of optical spectroscopy.

CHEM 624 Electrical Methods of Quantitative Analysis (3)
Prerequisites: CHEM 421 and CHEM 482 or equivalent. The use of conductivity, potentiometry, polarography, voltammetry, amperometry, coulometry, and chronopotentiometry in quantitative analysis.

CHEM 625 Separation Methods in Quantitative Analysis (3)
Prerequisites: CHEM 421 and CHEM 482 or equivalent. The theory and application for quantitative analysis of various forms of chromatography, ion exchange, solvent extraction, distillation, and mass spectroscopy.

CHEM 640 Problems in Organic Reaction Mechanisms (1)
A tutorial type course dealing with the basic description of the fundamentals of writing organic reaction mechanisms.

CHEM 641 Organic Reaction Mechanisms (3)

CHEM 643 Organic Chemistry of High Polymers (2)
An advanced course covering the synthesis of monomers, mechanisms of polymerization, and the correlation between structure and properties in high polymers.

CHEM 647 Organic Synthesis (3)
The use of new reagents in organic reactions; multistep syntheses leading to natural products of biological interest; stereospecific and regiospecific reactions and their use in total synthesis.

CHEM 648 Special Topics in Organic Chemistry (1-3)
Repeatable to 9 credits if content differs. Topics of special interest and current importance.

CHEM 650 Problems in Organic Synthesis (1)
A tutorial type course dealing with mechanistic problems from the current literature of organic sysnthesis.

CHEM 660 Spectral Methods (2)
The use of infrared, ultraviolet-visible, proton and carbon-13 nuclear magnetic resonance and mass spectroscopy for structure determination in organic chemistry.

CHEM 678 Special Topics in Environmental Chemistry (3)
Prerequisite: CHEM 474. Repeatable to 6 credits if content differs. In-depth treatment of environmental chemistry problem areas of current research interest. The topics will vary somewhat from year to year.

CHEM 681 Infra-red and Raman Spectroscopy (2)
Prerequisite: permission of department.

CHEM 682 Reaction Kinetics (3)

CHEM 684 Chemical Thermodynamics (3)
Prerequisite: CHEM 482 or equivalent.

CHEM 686 Chemical Crystallography (3)
Prerequisite: permission of instructor. A detailed treatment of single-crystal X-ray methods.

CHEM 687 Statistical Mechanics and Chemistry (3)
Prerequisite: CHEM 684 or equivalent.

CHEM 688 Selected Topics in Physical Chemistry (2)
Repeatable to 6 credits if content differs.

CHEM 689 Special Topics in Physical Chemistry (3)
Repeatable to 9 credits if content differs.

CHEM 690 Quantum Chemistry I (3)
Prerequisite: CHEM 485.

CHEM 691 Quantum Chemistry II (3)
Prerequisite: CHEM 690 or PHYS 622.

CHEM 699 Special Problems in Chemistry (1-6)
Prerequisite: one semester of graduate study in chemistry. Restricted to students in the non-thesis M.S. option. Repeatable to 6 credits. Laboratory experience in a research environment.

CHEM 702 Radiochemistry Laboratory (1-2)
One or two four-hour laboratory periods per week. *Pre- or corequisites: CHEM 403.*

CHEM 705 Nuclear Chemistry (3)
Nuclear structure models, radioactive decay processes, nuclear reactions in complex nuclei, fission, nucleosynthesis and nuclear particle accelerators.

CHEM 718 Special Topics in Nuclear Chemistry (1-3)
Repeatable to 6 credits. A discussion of current research problems.

CHEM 722 Cosmochemistry (3)
Prerequisite: CHEM 482 or equivalent. Current theories of origin and evolution of the solar system with emphasis on the experimental data available to chemists from examination of meteorites, the moon, and the earth.

CHEM 723 Marine Geochemistry (3)
Prerequisite: CHEM 481 or equivalent. The geochemical evolution of the ocean; composition of sea water, density-chlorinity-salinity relationship and carbon dioxide system. The geochemistry of sedimentation with emphasis on the chemical stability and inorganic and biological production of carbonate, silicate and phosphate containing minerals.

CHEM 729 Special Topics in Geochemistry (1-3)
Repeatable to 6 credits if content differs. A discussion of current research problems.

CHEM 750 Chemical Evolution (3)
Prerequisite: CHEM 441 and/or BCHM 462, or CHEM 721, or ZOOL 446, or BOTN 616. The chemical processes leading to the appearances of life on earth. Theoretical and experimental considerations related to the geochemical, organic, and biochemical phenomena of chemical evolution.

CHEM 799 Master's Thesis Research (1-6)

CHEM 898 Seminar (1)

CHEM 899 Doctoral Dissertation Research (1-8)

CHIN – Chinese

CHIN 401 Readings in Modern Chinese I (3)
Prerequisite: CHIN 302 or equivalent. Non-majors admitted only after a placement interview. Readings in history, politics, economics, sociology, and literature. Emphasis on wide-ranging, rapid reading, reinforced by conversations and compositions.

CHIN 402 Readings in Modern Chinese II (3)
Prerequisite: CHIN 401 or equivalent. Non-majors admitted only after a placement interview. Continuation of CHIN401.

CHIN 403 Classical Chinese I (3)
Prerequisite: CHIN 302. Introductory classical Chinese using literary and historical sources in the original language.

CHIN 404 Classical Chinese II (3)
Prerequisite: CHIN 302. Further classical studies by various writers from famous ancient philosophers to prominent scholars before the new culture movement.

CHIN 405 Advanced Conversation and Composition (3)
Prerequisite: CHIN 302 or permission of instructor. Non-majors admitted only after a placement interview. Practice in writing essays, letters, and reports on selected topics. Conversation directed toward everyday situations and topics related to life in China. Conducted in Chinese.

CHIN 415 Readings in Current Newspapers and Periodicals (3)
Prerequisite: CHIN 402 or equivalent. Non-majors admitted only after a placement interview. Reading of periodical literature on selected topics with discussions and essays in Chinese.

CHIN 421 Sounds and Transcriptions of Mandarin Chinese (3)
Production and recognition of Mandarin speech sounds and tones, their phonological patterns, comparison with English, and representation by the various Romanization systems.

CHIN 422 Advanced Chinese Grammar (3)
Chinese sentence patterns studied contrasted with English and in terms of current pedagogical as well as linguistic theories.

CHIN 431 Translation and Interpretation I (3)
Prerequisite: CHIN 202 or equivalent. Introduction to the history and theories of translation/interpretation; contrasts the structures of English and Chinese.

CHIN 432 Translation and Interpretation II (3)
Prerequisite: CHIN 431 or equivalent.

CHIN 441 Traditional Chinese Fiction (3)
Prerequisite: CHIN 314 or permission of instructor. Major works of fiction from the 4th century tales of the marvelous through the 19th century Ching novel. Taught in Chinese.

CHIN 442 Modern Chinese Fiction (3)
Prerequisite: CHIN 315 or permission of instructor. Examination, through selected texts, of the writer's role as shaper and reflector of the Republican and Communist revolutions. Taught in Chinese.

CHIN 499 Directed Study in Chinese (1-3)
Prerequisite: permission of instructor. Repeatable to 6 credits if content differs. Readings in Chinese under faculty supervision.

CHPH – Chemical Physics

CHPH 611 Fundamentals of Atomic and Molecular Spectroscopy (3)
Prerequisite: PHYS 622 or equivalent. Atomic and molecular physics. Energy levels of multi-electron atoms and diatomic molecules; transition between energy levels.

CHPH 612 Molecular Structure and Kinetics (3)
Prerequisite: permission of instructor. Molecular structure, atomic and molecular collisions and chemical kinetics including experimental techniques.

CHPH 618 Special Projects in Chemical Physics (1-3)
Prerequisite: permission of instructor. Repeatable to 6 credits. Independent reading and study covering chemical physics subject areas not available in other courses.

CHPH 709 Seminar in Chemical Physics (1)
Current research and developments in chemical physics.

CHPH 718 Special Topics in Chemical Physics (1-3)
Repeatable if content differs with permission of department. A discussion of current research problems in chemical physics.

CHPH 799 Master's Thesis Research (1-6)

CHPH 899 Doctoral Dissertation Research (1-8)

CJUS – Institute of Criminal Justice and Criminology

CJUS 400 Criminal Courts (3)
Prerequisite: CJUS 100 or permission of department. Criminal courts in the United States at all levels; judges, prosecutors, defenders, clerks, court administrators, and the nature of their jobs; problems facing courts and prosecutors today and problems of administration; reforms.

CJUS 444 Advanced Law Enforcement Administration (3)
Prerequisite: CJUS 340 or permission of department. The structuring of manpower, material, and systems to accomplish the major goals of social control. Personnel and systems management. Political controls and limitations on authority and jurisdiction.

CJUS 455 Dynamics of Planned Change in Criminal Justice I (3)
Prerequisite: permission of department. An examination of conceptual and practical issues related to planned change in criminal justice. Emphasis on the development of innovative ideas using a research and development approach to change.

CJUS 456 Dynamics of Planned Change in Criminal Justice II (3)
Prerequisite: CJUS 455 or permission of department. An examination of conceptual and practical issues related to planned change in criminal justice. Emphasis on change strategies and tactics which are appropriate for criminal justice personnel in entry level positions.

CJUS 462 Special Problems in Security Administration (3)
Prerequisite: CJUS 360. An advanced course for students desiring to focus on specific concerns in the study of private security organizations; business intelligence and espionage; vulnerability and criticality analyses in physical security; transportation, banking, hospital and military security problems; uniformed security forces; national defense information; and others.

CJUS 498 Selected Topics in Criminal Justice (1-6)
Prerequisite: permission of department. Repeatable to 6 credits if content differs. Supervised study of a selected topic to be announced in the field of criminal justice.

CJUS 600 Criminal Justice (3)
Prerequisites: admission to the graduate program in criminal justice or permission of department. Current concept of criminal justice in relationship to other concepts in the field. Historical perspective. Criminal justice and social control. Operational implications. Systemic aspects. Issues of evaluation.

CJUS 630 Seminar in Criminal Law and Society (3)
Prerequisite: CJUS 230 or or equivalent; and a course in introductory criminology. The criminal law is studied in the context of general studies in the area of the sociology of law. The evolution and social and psychological factors affecting the formulation and administration of criminal laws are discussed. Also examined is the impact of criminal laws and their sanctions on behavior in the light of recent empirical evidence.

CJUS 640 Seminar in Criminal Justice Administration (3)
Prerequisites: one course in the theory of groups or organizations; and one course in administration; or permission of department. Examination of external and internal factors that currently impact on police administration. Intra-organizational relationships and policy formulation; the conversion of inputs into decisions and policies. Strategies for formulating, implementing and assessing administrative decisions.

CJUS 650 Research Seminar in Public Policy and Crime Control (3)
Prerequisite: permission of department. Analysis of the political and organizational process of policy development and implementation in criminal justice. Collection, analysis and interpretation of research data on current and ongoing efforts to form and implement policy.

CJUS 699 Special Problems in Criminal Justice (1-3)
Prerequisite: permission of department. Repeatable to 6 credits. Supervised study of a selected problem in the field of criminal justice.

CJUS 720 Criminal Justice System Planning (3)
Prerequisites: one course in criminal justice and one course in research methodology. System theory and method; examination of planning methods and models based primarily on a systems approach to the operations of the criminal justice system.

CJUS 799 Master's Thesis Research (1-6)

CLAS – Classics

CLAS 411 Greek Drama (3)
Also offered as CMLT 411. *Credit will be granted for only one of the following: CLAS 411 or CMLT 411.* The chief works of Aeschylus, Sophocles, Euripides, and Aristophanes in English translations.

CLAS 420 The Classical Tradition (3)
Examination of the role of classical tradition in western thought, with particular regard to literature.

CLAS 470 Advanced Greek and Roman Mythology (3)
Prerequisite: CLAS 170 or permission of department. Selected themes and characters of Greek and Roman myth. History of the study of myth and research methods in mythology.

CLAS 488 Independent Study in Classical Civilization (3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs.

CLAS 494 Senior Seminar in Classics (3)
Limited to graduating classics majors. To be taken in the last year and preferably the last semester of the undergraduate program. Topics will vary each semester; most will be interdisciplinary or will cross historical periods. The course will provide a seminar experience in material or methodologies not otherwise available to the major.

CLAS 495 Senior Thesis in Classics (3)
Prerequisite: permission of department. Prior departmental approval of research topic is required. Available to all students who wish to pursue a specific research topic.

CLAS 499 Independent Study in Classical Languages and Literatures (1-3)
Prerequisite: permission of department.

CLAS 601 Intro to Graduate Study in Classics (3)
Introduction to the central problems and methods of investigation in the main fields of Classical studies.

CLAS 620 Classical Epic (3)
The nature of ancient epic, its development through a close reading of Homer's Iliad and Odyssey, the Argonautica of Apollonius of Rhodes, and Vergil's Aeneid. Selections from other examples of epic as a basis for further comparison of the techniques of composition, the poet's objectives, and the influence of historical context and literary precedent upon the poems. Comparison with Near Eastern epics such as the Gilgamesh poem, or with post-Classical texts. Epic conventions.

CLAS 621 The Classical Tradition (3)
The role the classics have played in western thought, with particular attention to literature.

CLAS 640 Women in Antiquity (3)
Study of role of women in Greek and Roman society.

CLAS 670 Classical Myth and Literature (3)
The nature and function of myth in Greek culture. Consideration of a variety of theoretical approaches to myth, beginning with those developed by the Greeks, allegory and euhemerism, and including Jungian and Freudian psychology, structuralism, and the myth-ritual school.

CLAS 688 Special Topics in Classical Civilization (3)
Repeatable to 9 credits if content differs.

CLAS 699 Independent Study in Classical Civilization (1-3)
Prerequisite: permission of instructor. Repeatable to 6 credits if content differs.

CLAS 799 Master's Thesis Research (1-6)

CMLT – Comparative Literature

CMLT 402 Introductory Survey of Comparative Literature (3)
Study of the medieval and modern continental literature.

CMLT 411 The Greek Drama (3)
Also offered as CLAS 411. *Credit will be granted for only one of the following: CMLT 411 or CLAS 411.* The chief works of Aeschylus, Sophocles, Euripides, and Aristophanes in English

translations. Emphasis on the historic background, on dramatic structure, and on the effect of the Attic drama upon the mind of the civilized world.

CMLT 415 The Old Testament As Literature (3)
A study of sources, development and literary types.

CMLT 416 New Testament As Literature (3)
A knowledge of Greek is helpful, but not essential. A study of the books of the New Testament, with attention to the relevant historical background and to the transmission of the text.

CMLT 421 The Classical Tradition and Its Influence in the Middle Ages and the Renaissance (3)
Reading knowledge of Greek or Latin required. Emphasis on major writers.

CMLT 422 The Classical Tradition and Its Influence in the Middle Ages and the Renaissance (3)
Reading knowledge of Greek and Latin required. Emphasis on major writers.

CMLT 430 Literature of the Middle Ages (3)
Narrative, dramatic and lyric literature of the middle ages studied in translation.

CMLT 433 Dante and the Romance Tradition (3)
A reading of the divine comedy to enlighten the discovery of reality in western literature.

CMLT 461 Romanticism: Early Stages (3)
Reading knowledge of French of German required. Emphasis on England, France and Germany.

CMLT 462 Romanticism: Flowering and Influence (3)
Reading knowledge of French and German required. Emphasis on England, France and Germany.

CMLT 469 The Continental Novel (3)
The novel in translation from Stendhal through the existentialists, selected from literatures of France, Germany, Italy, Russia, and Spain.

CMLT 470 Ibsen and the Continental Drama (3)
Emphasis on the major work of Ibsen, with some attention given to selected predecessors, contemporaries and successors.

CMLT 479 Major Contemporary Authors (3)

CMLT 488 Genres (3)
Repeatable to 6 credits if content differs. A study of a recognized literary form, such as tragedy, epic, satire, literary criticism, comedy, tragicomedy, etc.

CMLT 489 Major Writers (3)
Each semester two major writers from different cultures and languages will be studied. Authors will be chosen on the basis of significant relationships of cultural and aesthetic contexts, analogies between their respective works, and the importance of each writer to his literary tradition.

CMLT 498 Selected Topics in Comparative Literature (3)

CMLT 601 Problems in Comparative Literature (3)

CMLT 610 Folklore in Literature (3)

CMLT 631 The Medieval Epic (3)

CMLT 632 The Medieval Romance (3)

CMLT 639 Studies in the Renaissance (3)
Repeatable to 9 credits.

CMLT 642 Problems of the Baroque in Literature (3)

CMLT 649 Studies in Eighteenth Century Literature (3)
Repeatable to 9 credits. Studies in eighteenth century literature: as announced.

CMLT 658 Studies in Romanticism (3)
Repeatable to 9 credits. Studies in romanticism: as announced.

CMLT 679 Seminar in Modern and Contemporary Literature (3)
Repeatable to 9 credits. Seminar in modern and contemporary literature: as announced.

CMLT 681 Literary Criticism: Ancient and Medieval (3)

CMLT 682 Literary Criticism: Renaissance and Modern (3)

CMLT 799 Master's Thesis Research (1-6)

CMLT 801 Seminar in Themes and Types (3)

CMLT 899 Doctoral Dissertation Research (1-8)

CMSC – Computer Science

CMSC 400 Introduction to Computer Systems and Software (3)
Prerequisite: MATH 141 and expreience with a high-level programming language and (graduate standing or permission of department). Assembly language and instruction execution for Von Neumann Architectures. Records, arrays, pointers, parameters, and recursive procedures. I/O structures and interrupt handling. Finite state automata. Course is intended primarily for graduate students in other disciplines. CMSC 400 may not be counted for credit in the graduate or undergraduate program in computer science.

CMSC 411 Computer Systems Architecture (3)
Prerequisite: CMSC 311 or CMSC 400. Input/output processors and techniques. Intra-system communication, buses, caches. Addressing and memory hierarchies. Microprogramming, parallelism, and pipelining.

CMSC 412 Operating Systems (4)
Three hours of lecture and two hours of laboratory per week. *Prerequisite: (CMSC 311 and CMSC 330) or CMSC 400. Recommended: CMSC 411.* An introduction to batch systems, spooling systems, and third-generation multiprogramming systems. Description of the parts of an operating system in terms of function, structure, and implementation. Basic resource allocation policies.

CMSC 415 Systems Programming (3)
Prerequisite: CMSC 412. Basic algorithms of operating system software. Memory management using linkage editors and loaders, dynamic relocation with base registers, paging. File systems and input/output control. Processor allocation for multiprogramming, timesharing. Emphasis on practical systems programming, including projects such as a simple linkage editor, a stand-alone executive, a file system, etc.

CMSC 420 Data Structures (3)
Prerequisite: CMSC 251 or CMSC 400. Description, properties, and storage allocation of data structures including lists and trees. Algorithms for manipulating structures. Applications from areas such as data processing, information retrieval, symbol manipulation, and operating systems.

CMSC 421 Introduction to Artificial Intelligence (3)
Prerequisite: CMSC 251; and CMSC 330. Recommended: CMSC 420. Areas and issues in artificial intelligence, including search, inference, knowledge representation, learning, vision, natural languages, expert systems, robotics. Implementation and application of programming languages (e.g. LISP, PROLOG, SMALLTALK), programming techniques (e.g. pattern matching, discrimination networks) and control structures (e.g. agendas, data dependencies).

CMSC 424 Database Design (3)
Prerequisite: CMSC 420. Recommended: CMSC 450. Motivation for the database approach as a mechanism for modeling the real world. Review of the three popular data models: relational, network, and hierarchical. Comparison of permissible structures, integrity constraints, storage strategies, and query facilities. Theory of database design logic.

CMSC 426 Image Processing (3)
Prerequisite: CMSC 420. An introduction to basic techniques of analysis and manipulation of pictorial data by computer. Image input/output devices, image processing software, enhancement, segmentation, property measurement, Fourier analysis. Computer encoding, processing, and analysis of curves.

CMSC 430 Theory of Language Translation (3)
Prerequisite: CMSC 330 or CMSC 400. Formal translation of programming languages, program syntax and semantics. Finite state recognizers and regular grammers. Contextfree parsing techniques such as recursive descent, precedence, LL(k) and LR(k). Code generation, improvement, syntax-directed translation schema.

CMSC 434 Human Factors in Computer and Information Systems (3)
Prerequisite: CMSC 330; and PSYC 100; and STAT 400. Human factors issues in the development of software, the use of database systems, and the design of interactive computer systems. Experimentation on programming language control and data structures, programming style issues, documentation, program development strategies, debugging, and readability. Interactive system design issues such as response time, display rates, graphics, on-line assistance, command language, menu selection, or speech input/output.

CMSC 435 Software Design and Development (3)
Prerequisite: CMSC 420 and CMSC 430 or equivalent. State-of-the-art techniques in software design and development. Laboratory experience in applying the techniques covered. Structured design, structured programming, top-down design and development, segmentation and modularization techniques, iterative enhancement, design and code inspection techniques, correctness, and chief-programmer teams. The development of a large software project.

CMSC 450 Elementary Logic and Algorithms (3)
Prerequisite: MATH 240 or CMSC 250 or CMSC 150. Also offered as MATH 444. Credit will be granted for only one of the following: MATH 444 or CMSC 450. An elementary development of propositional logic, predicate logic, with an introductory treatment of Turing machines, recursive functions, unavoidable problems, and applications of logic in artificial intelligence.

CMSC 451 Design and Analysis of Computer Algorithms (3)
Prerequisites: CMSC 113; and CMSC 251. Fundamental techniques for designing and analyzing computer algorithms. Greedy methods, divide-and-conquer techniques, search and traversal techniques, dynamic programming, backtracking methods, branch-and-bound methods, and algebraic transformations.

CMSC 452 Elementary Theory of Computation (3)
Prerequisites: CMSC 113; and CMSC 251. Alternative theoretical models of computation, types of automata, and their relations to formal grammars and languages.

CMSC 456 Data Encryption and Security (3)
Prerequisites: CMSC 420. Recommended: CMSC 451. Methods of protecting computer data from unauthorized use and users by data encryption and by access and information controls. Classical cryptographic systems. Introduction to several modern systems such as Data Encryption Standard and public-key cryptosystems.

CMSC 460 Computational Methods (3)
Prerequisite: MATH 240 and MATH 241; and (CMSC 110 or CMSC 113). Also offered as MAPL 460. Credit will be granted for only one of the following: CMSC/MAPL 460 or CMSC/MAPL 466. Basic computational methods for interpolation, least squares, approximation, numerical quadrature, numerical solution of polynomial and transcendental equations, systems of linear equations and initial value problems for ordinary differential equations. Emphasis is on methods and their computational properties rather than their analytic aspects. Intended primarily for students in the physical and engineering sciences.

CMSC 466 Introduction to Numerical Analysis I (3)
Prerequisite: MATH 240; and MATH 241; and (CMSC 110 or equivalent). Also offered as MAPL 466. Credit will be granted for only one of the following: CMSC/MAPL 460 or CMSC/MAPL 466. Floating point computations, direct methods for linear systems, interpolation, solution of nonlinear equations.

CMSC 467 Introduction to Numerical Analysis II (3)
Prerequisite: MAPL/CMSC 466. Also offered as MAPL 467. Advanced interpolation, linear least squares, eigenvalue problems, ordinary differential equations, Fast Fourier Transforms.

CMSC 475 Combinatorics and Graph Theory (3)
Prerequisites: MATH 240 and MATH 241. Also offered as MATH 475. General enumeration methods, difference equations, generating functions. Elements of graph theory, matrix representations of graphs, applications of graph theory to transport networks, matching theory and graphical algorithms.

CMSC 477 Optimization (3)
Prerequisite: CMSC/MAPL 460, or CMSC/MAPL 466, or CMSC/MAPL 467. Also offered as MAPL 477. Credit will be granted for only one of the following: CMSC 477 or MAPL 477. Linear programming including the simplex algorithm and dual linear programs; convex sets and elements of convex programming; combinatorial optimization, integer programming.

CMSC 498 Special Problems in Computer Science (1-3)
Prerequisite: permission of department. An individualized course designed to allow a student or students to pursue a specialized topic or project under the supervision of the senior staff. Credit according to work done.

CMSC 612 Computer Systems Theory (3)
Prerequisites: CMSC 411; and CMSC 412; and STAT 400. Basic theoretical results in computer systems, including synthetic models of system structure, analytical (probabilistic) models of system structure, analysis of computer system mechanisms, analysis of operating system mechanisms, and analysis of resource allocation policies.

CMSC 620 Problem Solving Methods in Artificial Intelligence (3)
Prerequisites: CMSC 420; and CMSC 450. Underlying theoretical concepts in solving problems by heuristically guided trial and error search methods. State-space problem reduction, and first-order predicate calculus representations for solving problems. Search algorithms and their optimality proofs.

CMSC 624 Database Management Systems (3)
Prerequisite: CMSC 424 or permission of instructor. Theoretical and implementation issues of database systems. Topics include: data semantics and models, deduction and expert database systems, implementation techniques of database management systems, advanced access methods and query optimization, distributed databases, and database machine architecture.

CMSC 630 Theory of Programming Languages (3)
Prerequisite: CMSC 430. Contemporary topics in the theory of programming languages. Formal specification and program correctness. Axiomatic proof systems (both Floyd-Hoare and Dijkstra's predicate transformers), Mills' functional correctness approach, abstract data types (both abstract model and algebraic specifications), and Scott-style denotational semantics based on least fixed points.

CMSC 650 Theory of Computing (3)
Prerequisite: CMSC 452. Formal treatment of theoretical models of computation, computable and uncomputable functions, unsolvable decision problems, and computational complexity.

CMSC 651 Analysis of Algorithms (3)
Prerequisite: CMSC 451. Efficiency of algorithms, orders of magnitude, recurrence relations, lower-bound techniques, time and space resources, NP-complete problems, polynomial hierar-

chies, and approximation algorithms. Sorting, searching, set manipulation, graph theory, matrix multiplication, fast Fourier transform, pattern matching, and integer and polynomial arithmetic.

CMSC 660 Algorithmic Numerical Analysis (3)
Prerequisites: MATH/CMSC 460 OR 470, and CMSC 110. Detailed study of problems arising in the implementation of numerical algorithms on a computer. Typical problems include rounding errors, their estimation and control; numerical stability considerations; stopping criteria for converging processes; parallel methods. Examples from linear algebra, differential equations, minimization. (Also listed as MATH 684).

CMSC 666 Numerical Analysis I (3)
Prerequisites: CMSC/MAPL 466; and MATH 410. Also offered as MAPL 666. Iterative methods for linear systems, piecewise interpolation, eigenvalue problems, numerical integration.

CMSC 667 Numerical Analysis II (3)
Prerequisite: CMSC/MAPL 666. Also offered as MAPL 667. Nonlinear systems of equations, ordinary differential equations, boundary value problems.

CMSC 710 Performance Evaluation of Computer Systems (3)
Prerequisite: CMSC 412, MATH 141, and STAT 400 or equivalent. Performance evaluation methodologies. Methods for evaluating computer/communication systems. Analytical modeling using queueing theoretic approach. Simulation for performance evaluation. Applying theoretical methods by modeling computer system components. Case studies using analytical and simulation techniques.

CMSC 711 Computer Networks (3)
Prerequisite: CMSC 412 or equivalent. Priciples, design, and performance evaluation of computer networks. Network architectures including the ISO model and local area networks (LANs). Communication protocols and network topology.

CMSC 712 Distributed Algorithms and Verification (3)
Prerequisite: CMSC 612 or equivalent. Study of algorithms from the distributed and concurrent systems literature. Formal approach to specifying, verifying, and deriving such algorithms. Areas selected from mutual exclusion, resource allocation, quiescence detection, election, Byzantine agreements, routing, network protocols, and fault-tolerence. Formal approaches will handle system specification and verification of safety, liveness, and real-time properties.

CMSC 720 Logic for Problem Solving (3)
Prerequisite: CMSC 620. Logic programming and its use in problem solving, natural language recognition and parsing, and robotics. The PROLOG language. Meta-level and parallel logic programming. Expert systems. Term project in logic programming.

CMSC 723 Computational Linguistics (3)
Prerequisite: CMSC 420. Introductory course on applications of computational techniques to linguistics and natural-language processing. Research cycle of corpus selection, pre-editing, key-punching, processing, post-editing, and evaluation. General-purpose input, processing, and output routines. Special-purpose programs for sentence parsing and generation, segmentation, idiom recognition, paraphrasing, and stylistic and discourse analysis. Programs for dictionary, thesaurus, and concordance compilation, and editing. Systems for automatic abstracting, translation, and question-answering.

CMSC 727 Connectionist Models of Intelligent Systems (3)
Prerequisites: MATH 240 and MATH 241; and permission of instructor. Fundamental methods of connectionist modelling (neural modelling). Surveys historical development and recent research results from both the computational and dynamical systems perspective. Logical neurons, perceptrons, linear adaptive networks, adaptive resonance, energy minimizing models, competitive activation methods, error back-propagation, and tensor models. Applications in artificial intelligence, cognitive science, and neuroscience.

CMSC 730 Artificial Intelligence (3)
Prerequisites: CMSC 620; and STAT 401. Heuristic programming; tree search procedures. Programs for game playing, theorem finding and proving, and problem solving. Conversation with computers; question-answering programs. Trainable pattern classifiers:linear, piecewise linear, quadratic, and multilayer machines. Statistical decision theory, decision functions, likelihood ratios; mathematical taxonomy, cluster detection. Neural models, computational properties of neural nets, processing of sensory information, representative conceptual models of the brain.

CMSC 733 Computer Processing of Pictorial Information (3)
Prerequisite: CMSC 420. Input, output, and storage of pictorial information. Pictures as information sources, efficient encoding, sampling, quantization, approximation. Position-invariant operations on pictures, digital and optical implementations, the pax language, applications to matched and spatial frequency filtering. Picture quality, image enhancement and image restoration. Picture properties and pictorial pattern recognition. Processing of complex pictures; figure extraction, properties of figures. Data structures for pictures description and manipulation; picture languages. Graphics systems for alphanumeric and other symbols, line drawings of two- and three-dimensional objects, cartoons and movies.

CMSC 735 A Quantitative Approach to Software Management and Engineering (3)
Prerequisites: CMSC 435; and STAT 400 or permission of instructor. Introduction to the fundamental ideas for measuring and evaluating the software development process and product. Types of models and metrics currently in use. Paradigms for using practical measurement for managing and engineering the software development and maintenance process; evaluating software methods and tools; and improving productivity, quality and the effective use of methodology.

CMSC 750 Advanced Theory of Computation (3)
Prerequisite: CMSC 650. Continuation of CMSC 650. Relevant results and techniques from recursive function theory such as priority arguments. Current research topics in the foundation of computing, such as inductive inference and polynomial terseness.

CMSC 751 Parallel Algorithms (3)
Prerequisite: CMSC 451 or equivalent. A presentation of the theory of parallel computers and parallel processing. Models of parallel processing and the relationships between these models. Techniques for the design and analysis of efficient parallel algorithms including parallel prefix, searching, sorting, graph problems, and algebraic problems. Theoretical limits of parallelism, inherently sequential problems, and the theory of P-completeness.

CMSC 753 Mathematical Linguistics (3)
Prerequisites: CMSC 650 and STAT 400. Introductory course on applications of mathematics to linguistics. Elementary ideas in phonology, grammar and semantics. Automata, formal grammars and languages. Chomsky's theory of transformational grammars, Yngve's depth hypothesis and syntactic complexity. Markov-chain models of word and sentence generation, Shannon's information theory Carnap and Bar-Hillel's semantic theory, lexicostatistics and stylostatistics, Zipf's law of frequency and Mandelbrot's rank hypothesis. Mathematical models as theoretical foundation for computational linguistics.

CMSC 760 Advanced Linear Numerical Analysis (3)
Prerequisite: CMSC/MAPL 666 or permission of instructor. Also offered as MAPL 600. Formerly CMSC 770. Advanced topics in numerical linear algebra, such as dense eigenvalue problems, sparse elimination, iterative methods, and other topics.

CMSC 762 Numerical Solution of Nonlinear Equations (3)
Prerequisites: CMSC/MAPL 666; and CMSC/MAPL 667 or permission of instructor. Also offered as MAPL 604. Formerly CMSC 772. Numerical solution of nonlinear equations in one and several variables. Existence questions. Minimization methods. Selected applications.

CMSC 782 Modeling and Simulation of Physical Systems (3)
Prerequisites: CMSC 420; and STAT 400. Monte-Carlo and other methods of investigating models of interest to physical scientists. Generation and testing of random numbers. Probabilistic, deterministic and incomplete models.

CMSC 798 Graduate Seminar in Computer Science (1-3)

CMSC 799 Master's Thesis Research (1-6)

CMSC 818 Advanced Topics in Computer Systems (1-3)
Prerequisite: permission of instructor. Repeatable for credit. Advanced topics selected by the faculty from the literature of computer systems to suit the interest and background of students.

CMSC 828 Advanced Topics in Information Processing (1-3)
Prerequisite: permission of instructor. Repeatable for credit. Advanced topics selected by the faculty from the literature of information processing to suit the interest and background of students.

CMSC 838 Advanced Topics in Programming Languages (1-3)
Prerequisite: permission of instructor. Repeatable for credit. Advanced topics selected by faculty from the literature of programming languages to suit the interest and background of students.

CMSC 858 Advanced Topics in Theory of Computing (1-3)
Prerequisite: permission of instructor. Repeatable for credit. Advanced topics selected by the faculty from the literature of theory of computing to suit the interest and background of students.

CMSC 878 Advanced Topics in Numerical Methods (1-3)
Prerequisite: permission of instructor. Repeatable for credit. Advanced topics selected by the faculty from the literature of numerical methods to suit the interest and background of students.

CMSC 899 Doctoral Dissertation Research (1-8)

CNEC – Consumer Economics

CNEC 400 Research Methods (3)
Prerequisite: MATH 110 or MATH 115. Not open to students who have completed TEXT 400 or BMGT 230. Research methodology in textiles and consumer economics, with particular emphasis on the application of statistical concepts and techniques to the analysis of data from the areas of textiles and consumer economics.

CNEC 410 Consumer Finance (3)
Prerequisites: ECON 201; and ECON 203. Not open to students who have completed FMCD 441. An economic approach to the problems of income allocation and consumer financial planning, including income maximization, principles of asset choice, financial management and risk management. The effects of fiscal and monetary policies on lifetime economic planning.

CNEC 431 The Consumer and the Law (3)
A study of legislation affecting consumer goods and services. Topics covered include product safety and liability, packaging and labeling, deceptive advertising, and consumer credit. The implications of such legislation for consumer welfare with particular emphasis on the disadvantaged groups in our society will be examined.

CNEC 433 Consumer Law: Advertising and Solicitation (3)
Prerequisite: CNEC 431 or permission of department. An advanced study of the legal consequences of inducing consumers to enter into commercial transactions. Individual consumer remedies, collective consumer remedies and government regulation.

CNEC 435 Economics of Consumption (3)
Prerequisites: [ECON 201; and ECON 203] or [ECON 205 for non-majors]. The application of economic theory to a study of consumer decision-making and its role in a market economy at

both the individual and aggregate levels. Topics covered include empirical studies of consumer spending and saving, the consumer in the market and collective consumption.

CNEC 437 Consumer Behavior (3)
Prerequisites: PSYC 100; and SOCY 100. An application of the behavioral sciences to a study of consumer behavior. Current theories, models and empirical research findings are explored.

CNEC 455 Product Standards (3)
Prerequisite: permission of department. The process of product standard development, and the significance of such standards to the consumer. History, procedures and uses of standards by industry and government, including both voluntary and regulatory standardization; the impact of product standards, and mechanisms for obtaining consumer input in the standardization process.

CNEC 456 Product Liability and Government Regulation (3)
Prerequisite: CNEC 431 or permission of department. Legal concepts involved in society's determination of consumer's rights to product safety. Litigation determining the obligation of manufacturers and sellers to injured consumers. Government regulations defining the obligations of manufacturers to design and construct products in accordance with government standards.

CNEC 457 Product Safety (3)
Prerequisite: permission of department. An interdisciplinary investigation of consumer product safety. Major statutes and agencies regulating safety. Alternative means of promoting consumer product safety. The application of product liability and cost benefit analysis to the economics of product safety. Consumer response to safety labeling, advertising and educational efforts.

CNEC 488 Senior Honors Thesis (1-4)
Limited to undergraduate students in the departmental honors program. An independent literary, laboratory or field study, conducted throughout the student's senior year. Student should register in both fall and spring.

CNEC 498 Special Studies (2-4)
Independent study by an individual student or by a group of students in advanced work not otherwise provided in the department. Students must prepare a description of the study they wish to undertake. The plan must be approved by the faculty directing the study and the department chairman.

CRIM – Criminology

CRIM 432 Law of Corrections (3)
Prerequisite: CJUS 230 or CJUS 234; and CRIM 220. A review of the law of criminal corrections from sentencing to final release or release on parole. Probation, punishments, special treatments for special offenders, parole and pardon, and the prisoner's civil rights are also examined.

CRIM 450 Juvenile Delinquency (3)
Prerequisite: CRIM 220. Juvenile delinquency in relation to the general problem of crime; analysis of factors underlying juvenile delinquency; treatment and prevention.

CRIM 451 Crime and Delinquency Prevention (3)
Prerequisite: CRIM 220 or CRIM 450 or permission of department. Methods and programs in prevention of crime and delinquency.

CRIM 452 Treatment of Criminals and Delinquents (3)
Prerequisite: CRIM 220 or CRIM 450 or permission of department. Processes and methods used to modify criminal and delinquent behavior.

CRIM 454 Contemporary Criminological Theory (3)
Prerequisite: [CRIM 220; and CRIM 450; and CRIM 451] or [CRIM 452 or CRIM 453]. Brief historical overview of criminological theory up to the 50's. Deviance. Labeling. Typologies. Most

recent research in criminalistic subcultures and middle class delinquency. Recent proposals for "decriminalization".

CRIM 455 Psychology of Criminal Behavior (3)
Prerequisite: CRIM 220 or equivalent; and PSYC 331 or equivalent. Biological, environmental, and personality factors which influence criminal behaviors. Biophysiology and crime, stress and crime, maladjustment patterns, psychoses, personality disorders, aggression and violent crime, sex-motivated crime and sexual deviations, alcohol and drug abuse, and criminal behavior.

CRIM 456 White Collar and Organized Crime (3)
Prerequisite: CRIM 220 or CRIM 450. Definition, detection, prosecution, sentencing and impact of white collar and organized crime. Special consideration given to the role of federal law and enforcement practices.

CRIM 457 Comparative Criminology (3)
Prerequisite: CRIM 220 or CRIM 450. Comparison of law and criminal justice systems in different countries. Special emphasis on the methods of comparative legal analysis, international cooperation in criminal justice, and crime and development.

CRIM 498 Selected Topics in Criminology (3)
Repeatable to 6 credits if content differs. Topics of special interest to advanced undergraduates in criminology. Such courses will be offered in response to student request and faculty interest.

CRIM 610 Research Methods in Criminal Justice and Criminology (3)
Prerequisite: completion of research methods and statistics requirements for the M.A. Degree. Examination of special research problems and techniques.

CRIM 650 Advanced Criminology (3)
Survey of the principal issues in contemporary criminological theory and research.

CRIM 651 Seminar in Criminology (3)
Analysis of significant recent issues in Criminology.

CRIM 652 Seminar in Juvenile Delinquency (3)
Analysis of delinquency and its control.

CRIM 653 Crime and Delinquency as a Community Problem (3)
An intensive study of selected problems in adult crime and juvenile delinquency in Maryland.

CRIM 654 History of Criminological Thought (3)
Prerequisite: CRIM 454 or equivalent. A study of the development of criminological thought from antiquity to the present.

CRIM 699 Special Criminological Problems (1-3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs. Supervised study of selected problems in the field of criminology.

CRIM 710 Advanced Research Methods in Criminology (3)
Prerequisite: approved doctoral level statistics course. Application of advanced research methods and data analysis strategies to criminological and criminal justice problems.

CRIM 799 Master's Thesis Research (1-6)

CRIM 899 Doctoral Dissertation Research (1-8)
Doctoral dissertation research in criminal justice and criminology.

DANC – Dance

DANC 410 Technical Theater Production for Dance (3)
Two hours of lecture and two hours of laboratory per week. *Prerequisite: DANC 210 or equivalent (or permission of department).* A study of the theoretical principles of production and the practical application of those principles to the presentation of dance works.

DANC 411 Dance Management and Administration (3)
Principles of dance management and administration, including organization of touring, bookings, budgets, public relations, grantsmanship and audience development.

DANC 428 Advanced Ballet Technique I (1)
Two hours of laboratory per week. *Prerequisite: DANC 329 or audition. Repeatable to 3 credits.* Advanced ballet technique with emphasis on physical and expressive skills.

DANC 429 Advanced Ballet Technique II (1)
Two hours of laboratory per week. *Prerequisite: DANC 428. Repeatable to 3 credits.* Intensive work in ballet technique for the professionally-oriented dancer.

DANC 448 Modern Dance V for Majors (3)
Prerequisite: DANC 349 or audition. Repeatable to 6 credits. Complex phrases of modern dance movement with emphasis on articulation and expression.

DANC 449 Modern Dance VI for Majors (3)
Prerequisite: DANC 448 or audition. Repeatable to 6 credits. Continuation of DANC 448.

DANC 466 Laban Movement Analysis (3)
Introduction to Rudolf Laban's system of qualitative movement analysis in relation to understanding personal movement style. Application to dance performance, teaching, composition and research.

DANC 468 Modern Repertory (3)
Prerequisite: DANC 349 or permission of department. Repeatable to 6 credits if content differs. Form, content, music, design and performance of modern dance works.

DANC 471 Movement Behavior (3)
The social psychology of movement; reciprocity of physical and emotional behavior.

DANC 479 Advanced Practicum in Dance (1-3)
Repeatable to 6 credits. Advanced level performing experience for the student dancer who has developed an advanced professional level of competence.

DANC 482 History of Dance I (3)
Prerequisite: DANC 200. The development of dance from primitive times to the Middle Ages and the relationship of dance forms to patterns of culture.

DANC 483 History of Dance II (3)
Prerequisite: DANC 200. The development of dance from the Renaissance period to the present time and the relationship of dance forms to patterns of culture.

DANC 484 Philosophy of Dance (3)
Prerequisite: DANC 200 or permission of department. Critical analysis of dance as a creative experience and the role of professional, educational and recreational dance in our society. Selected approaches to current developments in dance.

DANC 489 Special Topics in Dance (1-3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs. Theoretical, choreographic, pedagogic, or performance study.

DANC 499 Practicum in Choreography, Production and Performance IV (1-6)
Prerequisite: permission of permission of department. Repeatable to 6 credits. Advanced workshop in dance presentation, including performing, production and planned field experiences.

DANC 600 Introduction to Graduate Studies in Dance (3)
Prerequisite: permission of department. Supervised writing of reports and articles on selected dance subjects. Study of library resources and interviewing techniques. Preparation for written documentation of thesis project.

DANC 608 Choreography for Groups (3)
One hour of lecture and four hours of laboratory per week. *Prerequisite: DANC 388 or equivalent. Repeatable to 6 credits.* An advanced course in the development of choreographic ideas for groups emphasizing the exploration of different approaches to choreographic form.

DANC 610 Workshop in the Direction of Dance Production (3)
Two hours of lecture and two hours of laboratory per week. *Prerequisite: DANC 410 or equivalent.* A lecture/laboratory course dealing with the relationship of the director to all of the activities involved in the presentation of a dance concert.

DANC 648 Advanced Modern Dance Technique I (2)
Four hours of laboratory per week. *Prerequisite: DANC 449 or equivalent. Repeatable to 6 credits.* Professional level training in contemporary dance techniques.

DANC 649 Advanced Modern Dance Technique II (2)
Four hours of laboratory per week. *Prerequisite: DANC 648 or equivalent. Repeatable to 6 credits.* A continuation of DANC 648.

DANC 679 Graduate Dance Performance (1-3)
One hour of lecture and four hours of laboratory per week. *Prerequisite: permission of department. Repeatable to 6 credits.* An advanced performance course focusing on the restagings from noted scores of the choreographic works of significant artists in the field.

DANC 698 Independent Study in Dance (1-3)
Prerequisite: permission of department. Repeatable to 6 credits. Directed independent study in theoretical topics.

DANC 708 Advanced Seminar in Choreography (1-3)
One hour of lecture and four hours of laboratory per week. *Prerequisite: DANC 608 or permission of department. Repeatable to 6 credits.*

DANC 779 Master's Tutorial for Performance (1-3)
Prerequisite: permission of department. Repeatable to 6 credits. Supervised performance experience for advanced dancers.

DANC 782 Historical Perspectives in Dance (3)
Prerequisite: DANC 483 or equivalent. An advanced survey of the development of thearetical dance in the Western world with a special emphasis on the relationship between dance and other performing arts.

DANC 783 Current Trends in Dance (3)
Prerequisite: DANC 483 or equivalent. A survey of current trends in dance with an emphasis on developments in the United States covering choreographic and performance practice, theory and criticism, education, economics, and the mass media.

DANC 788 Master's Tutorial for Choreography (1-3)
Prerequisite: permission of department. Repeatable to 6 credits. Supervised production and presentation of a significant choreographic project.

DANC 799 Master's Thesis Project (1-6)
Prerequisite: permission of department.

ECON – Economics

ECON 402 Macroeconomic Models and Forecasting (3)
Prerequisite: ECON 305 or ECON 405. Analysis of the fluctuations in economic activity and the formulation and use of forecasting models of the economy. Illustrations of computer macro models and forecasting problems.

ECON 405 Advanced Intermediate Macroeconomic Theory (3)
Prerequisite: ECON 201; and ECON 203; and MATH 220 or equivalent. Credit will be granted for only one of the following: ECON 305 or ECON 405. Advanced treatment of the theory of

national income determination, employment, prices and growth. Models of the role of money and expectations, the impact of fiscal and monetary policies, and exchange rates.

ECON 406 Advanced Intermediate Microeconomic Theory (3)
Prerequisite: ECON 201; and ECON 203; and MATH 220 or equivalent. Credit will be granted for only one of the following: ECON 306 or ECON 406. Advanced treatment of the theory of prices and markets. Analysis of the theory of the household and of the firm, concepts of general equilibrium and welfare economics and principles of efficient and equitable allocations.

ECON 416 Theory of Economic Development (3)
Prerequisite: ECON 305 or ECON 405. Credit will be granted for only one of the following: ECON 315 or ECON 416. Economic theory of the developing nations; role of innovation, capital formation, resources, institutions, trade and exchange rates, and governmental policies.

ECON 418 Economic Development of Selected Areas (3)
Prerequisite: ECON 315 or ECON 416. Institutional characteristics of a specific area are discussed and alternate strategies and policies for development are analyzed.

ECON 422 Quantitative Methods in Economics I (3)
Prerequisite: ECON 201; and ECON 203; and [ECON 321 or BMGT 230;] or permission of department. Emphasizes the interaction between economic problems and the assumptions employed in statistical theory. Formulation, estimation, and testing of economic models, including single variable and multiple variable regression techniques, theory of identification, and issues relating to inference. Independent work relating the material in the course to an economic problem chosen by the student is required.

ECON 423 Quantitative Methods in Economics II (3)
Prerequisite: ECON 422. Interaction between economic problems and specification and estimation of econometric models. Topics include issues of autocorrelation, heteroscedasticity, functional form, simultaneous equation models, and qualitative choice models.

ECON 424 Computer Methods in Economics (3)
Prerequisites: ECON 201; and ECON 203; and (ECON 321 or BMGT 230). Computer modelling of economic problems, including household and firm behavior, macroeconomic relationships, statistical models of economy, and simulation models.

ECON 425 Mathematical Economics (3)
Prerequisites: ECON 305 or ECON 405, and ECON 306 or ECON 406, and MATH 220 or equivalent. Mathematical developments of theory of household and firm, general equilibrium and welfare economics, market imperfections, and role of information.

ECON 430 Money and Banking (3)
Prerequisites: ECON 201 and ECON 203. Credit will be granted for only one of the following: ECON 430 or ECON 431. The structure of financial institutions and their role in the provision of money and near money. Analysis of the Federal Reserve System, the techniques of central banks, and the control of supply of financial assets in stabilization policy. Relationship of money and credit to economic activity and the price level.

ECON 431 Theory of Money, Prices and Economic Activity (3)
Prerequisite: ECON 305 or ECON 405. Credit will be granted for only one of the following: ECON 430 or ECON 431. Monetary theory and the role of money, financial institutions and interest rates in macro models. Analysis of money demand and supply and of the Monetarist-Keynesian debate as they affect inflation and stabilization policy.

ECON 440 International Economics (3)
Prerequisites: ECON 201 and ECON 203. Credit will be granted for only one of the following: ECON 440 or ECON 441. A description of international trade and the analysis of international

transactions, exchange rates, and balance of payments. Analysis of policies of protection, devaluation, and exchange rate stabilization and their consequences.

ECON 441 Theory of International Economics (3)
Prerequisite: ECON 305 or ECON 405; and ECON 306 or ECON 406. Credit will be granted for only one of the following: ECON 440 or ECON 441. Theoretical treatment of international trade and international finance. Includes Ricardian and Heckscher-Ohlin theories of comparative advantage, analysis of tariffs and other trade barriers, international factor mobility, balance of payments adjustments, exchange rate determination, and fiscal and monetary policy in an open economy.

ECON 450 Introduction to Public Sector Economics (3)
Prerequisite: [ECON 201; and ECON 203] or ECON 205. Credit will be granted for only one of the following: ECON 450 or ECON 454. The role of federal, state, and local governments in meeting public wants. Analysis of theories of taxation, public expenditures, government budgeting, benefit-cost analysis and income redistribution, and their policy applications.

ECON 451 Public Choice and Public Policy (3)
Prerequisite: [ECON 201; and ECON 203], or ECON 205. Analysis of collective decision making, economic models of government, program budgeting, and policy implementation; emphasis on models of public choice and institutions which affect decision making.

ECON 454 Theory of Public Finance and Fiscal Federalism (3)
Prerequisite: ECON 306 or ECON 406. Credit will be granted for only one of the following: ECON 450 or ECON 454. Study of welfare economics and the theory of public goods, taxation, public expenditures, benefit-cost analysis, and state and local finance. Applications of theory to current policy issues.

ECON 460 Industrial Organization (3)
Prerequisite: ECON 306 or ECON 406. Changing structure of the American economy; price policies in different industrial classifications of monopoly and competition in relation to problems of public policy.

ECON 465 Health Care Economics (3)
Prerequisite: ECON 203 or ECON 205. Analysis of health care, the organization of its delivery and financing. Access to care; the role of insurance; regulation of hospitals, physicians, and the drug industry; role of technology; and limits on health care spending.

ECON 470 Theory of Labor Economics (3)
Prerequisite: ECON 306 or ECON 406. Credit will be granted for only one of the following: ECON 370 or ECON 470. An analytical treatment of theories of labor markets. The theory of human capital and allocation of time in household labor supply models; marginal productivity theory of labor demand; market structure and the efficiency of labor markets; information theory and screening; discrimination; distribution of income; and unemployment.

ECON 471 Current Problems in Labor Economics (3)
Prerequisite: ECON 470. For students who wish to pursue, in depth, selected topics in the labor field. Issues and topics selected for detailed examination may include: manpower training and development, unemployment compensation and social security, race and sex discrimination in employment, wage theory, productivity analysis, the problems of collective bargaining in public employment, wage-price controls and incomes policy.

ECON 482 Economics of the Soviet Union (3)
Prerequisite: [ECON 201 and ECON 203] or ECON 205. An analysis of the organization, operating principles and performance of the Soviet economy with attention to the historical and ideological background, planning, resources, industry, agriculture, domestic and foreign trade, finance, labor, and the structure and growth of national income.

ECON 484 The Economy of China (3)
Prerequisite: [ECON 201; and ECON 203] or ECON 205. Policies and performances of the Chinese economy since 1949. A survey of modern China's economic history. Emphasizes the strategies and institutional innovations that the Chinese have adopted to overcome the problems of economic development. Some economic controversies raised during the "Cultural Revolution" will be covered in review of the problems and prospects of the present Chinese economy.

ECON 486 The Economics of National Planning (3)
Prerequisite: [ECON 201; and ECON 203]; or ECON 205. An analysis of the principles and practice of economic planning with special reference to the planning problems of West European countries and the United States.

ECON 490 Survey of Urban Economic Problems and Policies (3)
Prerequisites: [ECON 201 and ECON 203] or ECON 205. An introduction to the study of urban economics through the examination of current policy issues. Topics may include suburbanization of jobs and residences, housing and urban renewal, urban transportation, development of new towns, ghetto economic development, problems in services such as education and police.

ECON 492 Economics of Location and Regional Growth (3)
Prerequisite: ECON 306 or ECON 406 or permission of department. Study of the theories, problems, and policies of regional economic development and the location of economic activity for both rural and metropolitan regions. Methods of regional analysis.

ECON 600 Analytical Techniques for Economists (3)
Vectors, matrices and determinants to model static equilibrium. Comparative statics using differential calculus. Problems in microeconomics and macroeconomics involving unconstrained optimization. Problems in microeconomics and macroeconomics involving constrained optimization. Economic dynamics using differential and difference equations, and Kuhn-Tucker Theory.

ECON 601 Macroeconomic Analysis I (3)
Three hours of lecture and two hours of laboratory per week. Prerequisite: ECON 600 or permission of instructor. Introductory technical treatment of standard Keynesian, classical and new classical macroeconomic models. Expectations formation and microeconomic foundations of consumption, investment, money demand, and labor market behavior.

ECON 602 Macroeconomic Analysis II (3)
Three hours of lecture and two hours of laboratory per week. *Prerequisite: ECON 601.* Rational expectations: the Lucas critique, misperceptions, business cycles, and persistence; real business cycles; policy ineffectiveness and effectiveness; optimal policy rules and time inconsistency; efficient markets hypothesis. Unemployment theory: unemployment and wage behavior in fix-price models, implicit contracts, and efficiency wage models; hysteresis. Theory of production; aggregation and index number theory; capital theory; theory of economic growth and asociated measurement issues.

ECON 603 Microeconomic Analysis I (3)
Three hours of lecture and two hours of laboratory per week. *Prerequisite: ECON 600 or permission of instructor.* A detailed treatment of the theory of the consumer and of the firm, particularly emphasizing the duality approach. Topics include uncertainty, the household production model, imperfect competition, monopolilstic and oligopolistic markets.

ECON 604 Microeconomic Analysis II (3)
Three hours of lecture and two hours of laboratory per week. *Prerequisite: ECON 603.* Analysis of markets and market equilibria; the Arrow-Debreu model of general equilibrium, the two-sector model, welfare theorems, externalities, public goods, markets with incomplete and asymmetric information, game theory.

ECON 605 Welfare Economics (3)
Prerequisite: ECON 603. First semester. The topics covered include Pareto optimality, social welfare funtions, indivisibilities, consumer surplus, output and price policy in public enterprise, and welfare aspects of the theory of public expenditures.

ECON 606 History of Economic Thought (3)
Prerequisite: ECON 403 or permission of department. First semester. A study of the development of economic thought and theories including the Greeks, Romans, Canonists, Mercantilists, Physiocrats, Adam Smith, Malthus, Ricardo. Relation of ideas to economic policy.

ECON 607 Economic Theory in the Nineteenth Century (3)
Prerequisite: ECON 606 or permission of department. Second semester. A study of nineteenth-century and twentieth-century schools of economic thought, particularly the Classicists, Neo-Classicists, Austrians, German historical school, American economic thought, the Socialists, and Keynes.

ECON 611 Seminar in American Economic Development (3)

ECON 613 Origins and Development of Capitalism (3)
Second semester. Studies the transition from feudalism to modern capitalistic economies in Western Europe. Whenever possible, this economic history is analyzed with the aid of tools of modern economics, and in the light of comparisons and contrasts with the less developed areas of the present day.

ECON 615 Economic Development of Underdeveloped Areas (3)
Prerequisites: ECON 401 and ECON 403. First semester. An analysis of the forces contributing to and retarding economic progress in underdeveloped areas. Macro and microeconomic aspects of development planning and strategy are emphasized.

ECON 616 Seminar in Economic Development (3)
Prerequisite: ECON 615 or permission of department. Second semester. A continuation of ECON 615. Special emphasis on the application of economic theory in the institutional setting of a country or area of particular interest to the student.

ECON 621 Quantitative Economics I (3)
First semester. An introduction to the theory and practice of statistical inference. Elements of computer programming and a review of mathematics germane to this and other graduate economics courses are included.

ECON 622 Quantitative Economics II (3)
Prerequisite: ECON 621. Techniques of estimating relationships among economic variables. Multiple regression, the analysis of variance and covariance, and techniques for dealing with time series. Further topics in mathematics.

ECON 623 Econometrics I (3)
Introduction to and development of aspects of mathematical statistics relevant for econometrics; distribution theory and inference. Topics considered include: random variables, density functions, moment generating functions, maximum likelihood estimators, sufficient statistics.

ECON 624 Econometrics II (3)
Prerequisite: ECON 623. Formal treatment of regression analysis; emphasis on formulation, specifications, and estimation of single equation models; elements of computer usage; experience with problems and examples.

ECON 625 Quantitative Methods in Practice (3)
Prerequisite: ECON 621 or equivalent. Practical experience in applying quantitative methods to economic data using computers. Proficiency in techniques, creativity in model formulation, and judgment in model evaluation are stressed.

ECON 661 The Corporate Firm (3)
Prerequisites: ECON 603, and ECON 662 or ECON 624. The modern firm; review of the theory of profit; neoclassical and managerial theories of the firm. Decisions of the firm: investment, research and development, advertising, mergers; analysis of determinants and effects of these decisions. Theoretical and empirical studies of the firm.

ECON 662 Industry Structure, Conduct, and Performance (3)
Prerequisites: ECON 603, and ECON 622 or ECON 624. Determinants of industry structures; structural effects on firm conduct and performance. Plant and firm economies of scale and their relation to concentration levels. Industry entry barriers; competitive, oligopolistic, and monopolistic pricing. Impact of concentration, entry barriers, and other structure variables on prices and profits of the industry. Social cost of market power.

ECON 663 Antitrust Policy and Regulation (3)
Prerequisites: ECON 603; and ECON 622 or ECON 624. U.S. antitrust policy after 1890; actual policies compared to theoretical policies to promote economic efficiency. Development of policy toward monopolies, cartels, mergers, and patents. Models of the regulatory process and empirical evidence. Studies of regulation of electricity, transportation, airlines, and other industries. Economics of product safety. Regulation of drugs, automobiles, food, and other products.

ECON 670 The Economics of Labor Markets (3)
Prerequisite: ECON 603 or permission of department. Economics of labor markets with trade unions and governmental control. Employer-employee relations in the public, voluntary, and private sectors. Nature of unions in bargaining and their impact on relative wages, wage levels, productivity, employment, inflation. Economic goals and consequences of public control, bargaining, and employment conditions.

ECON 681 Comparative Economic Systems and Economic Planning (3)
Theory and practice of economic systems that differ markedly from competitive capitalist system; command economies, in particular the Soviet Union; planned capitalist economies, including French and Dutch experience; self-managed systems (Yugoslavia); and market socialism (Hungary). Emphasis on the nature of institutions and on applying economic tools.

ECON 682 Topics in Comparative Economic Systems (3)
Prerequisite: ECON 681. Detailed analysis of planned economic systems; theoretical study of neoclassical, input-output, and development planning models; use of economic analysis to understand the behavior and development of the economies of Western Europe, the USSR, Eastern Europe, and China.

ECON 684 Seminar in Economic Development of the Soviet Union (3)
Measurement and evaluation of Soviet economic growth; interpretation and use of Soviet statistics; planning and economic administration; manpower and wage policies; foreign trade and aid. Selected topics in Bloc development and reform.

ECON 698 Selected Topics in Economics (3)

ECON 700 Applied Economic Theory (3)
Applied economic theory designed primarily for master's degree students. Topics from microeconomic and macroeconomic theory, including applied welfare economics, consumer surplus, public goods and externalities, investment theory, economic growth, and a review of IS-LM analysis.

ECON 701 Advanced Macroeconomics I (3)
Prerequisite: ECON 601; and ECON 602. Recent developments in macroeconomics with an emphasis on topics and techniques useful for conducting research in macroeconomics. Topics include advanced treatment of fiscal and monetary policy issues; the role of imperfect competition; real, sectoral and nominal business cycle models.

ECON 702 Advanced Macroeconomics II (3)
Disequilibrium macroeconomic models; models of persistence and hysteresis; models of nominal and real rigidities; macroeconomic time series estimation techniques including cointegration and method-of-moments estimation procedures.

ECON 703 Advanced Microeconomics I (3)
Prerequisites: ECON 603 and ECON 604. Normative and descriptive theory of social choice: including alternative axiomatizations, possibility theorems, and impossibility theorems. The implications of uncertainty for microeconomic behavior using axioms of choice and the expected utility theorem. Noncooperative games, including extensive and normal forms, Nash equilibrium, and applications to voting models and imperfect competition.

ECON 704 Advanced Microeconomics II (3)
Prerequisites: ECON 603 and ECON 604. General equilibrium theory and its relation to the core, the convergence theorem, and temporary equilibrium in a sequence of markets. The role of information in various economic organizations: including coordination and incentives under incomplete information, the principal-agent problem, search, and signaling. Principles of efficient and optimal allocation over time, and applications to capital accumulation and taxation.

ECON 705 Seminar in Institutional Economic Theory (3)
Second semester. A study of the recent developments in the field of institutional economic theory in the United States and abroad.

ECON 706 Seminar in Institutional Economic Theory (3)

ECON 721 Econometrics III (3)
Prerequisite: ECON 624. Additional topics on the single equation model, including autocorrelation, heteroskedasticity, dummy variables, maximum likelihood estimation, and functional forms. Consideration of systems problems.

ECON 722 Econometrics IV (3)
Prerequisite: ECON 721. Nonlinear econometric systems, simulation, dynamic properties of models, disequilibrium systems, random parameter models, Bayesian analysis, Stochastic control, and other topics. Emphasis on applications to micro and macro models, to value-of-information problems, and to other problems.

ECON 731 Monetary Economics (3)
Implementation of monetary policy: targets and instruments. Tobin's asset accumulation models. Transactions demand for money: Clower constraints, cash-in-advance models, legal restrictions. Asset demand for money, portfolio diversification, and overlapping generations models. Elements of finance: Capital Asset Pricing Models, arbitrage pricing theory, pricing of state-contingent claims. The term structure of interest rates.

ECON 732 Seminar in Monetary Theory and Policy (3)
Prerequisite: ECON 731 or permission of department. Second semester. Theory of the mechanisms through which central banking affects economic activity and prices; formation and implementation of of monetary policy; theoretical topics in monetary policy.

ECON 741 Advanced International Economics I (3)
Prerequisite: ECON 601. The international mechanism of adjustment: price, exchange rate, and income changes. The flexible exchange rate system, international monetary reform and international investment and capital flows.

ECON 742 Advanced International Economics II (3)
Prerequisite: ECON 603 and ECON 741. The pure theory of international trade. Comparative costs, the Heckscher-Ohlin Theorem, and the effect of trade on factor prices. Tariff analysis, commercial policy and customs unions. The gains from trade and ranking of policy interventions.

ECON 751 Advanced Theory of Public Finance (3)
Review of utility analysis to include the theory of individual consumer resource allocation and exchange and welfare implications. Effects of alternative tax and subsidy techniques upon allocation, exchange, and welfare outcomes. Theories of public goods, their production, exchange and consumption. Principles of benefit-cost analysis for government decisions.

ECON 752 Seminar in Public Finance (3)
Second semester. Theory of taxation and tax policy, with particular emphasis on income taxation; empirical studies; the burden of the public debt. Research paper by each student to be presented to seminar.

ECON 755 Theory of Public Choice I (3)
Prerequisite: permission of department. An examination of rationality in individual and collective decision-making with particular reference to the theory of games. The reasons why nonmarket collective decision procedures are required, the properties of several voting rules, and their normative implications. Majority rule, the unanimity rule, the Borda rule, and the demand revealing process. The properties of various representative voting mechanisms.

ECON 756 Theory of Public Choice II (3)
Prerequisite: ECON 755 or permission of department. The normative properties of collective choice procedures. Specific reference to the theories of justice advanced by Rawls, Nozick and others; and the import of contractarian theories in general. The impossibility theorems of Arrow and Sen. Problems raised by voter ignorance and bounded rationality. The theory of bureaucracy.

ECON 771 Advanced Labor Economics: Theory and Evidence (3)
Prerequisite: ECON 603, and ECON 622, or ECON 624, or permission of instructor. Modern analytical and quantitative labor economics. Labor supply decisions of individuals and households; human capital model and distribution of income. Demand for labor; marginal productivity theory, imperfect information and screening. Interaction of labor demand and supply; unemployment; relative and absolute wages; macroeconomic aspects of the labor market.

ECON 772 Government Policy and the Labor Market (3)
Prerequisite: ECON 771 or permission of department. Impact of governmental programs on the labor market. Programs examined chosen from among: employment training and public employment programs; public assistance; unemployment insurance, social security, wage-setting policies such as fair labor standards act and Davis-Bacon act; policies toward unionization; antidiscrimination programs.

ECON 781 Advanced Environmental Economics (3)
Prerequisite: ECON 603; and ECON 621, or permission of department. Theory of externalities, microeconomic models of pollution damage functions, benefits and costs of alternative pollution control measures, macroeconomic models of material and energy balance, limits to economic growth and long-run problems of intergenerational and interregional efficiency and equity.

ECON 785 Advanced Economics of Natural Resources (3)
Prerequisite: ECON 603 and ECON 621, or permission of department. The rate of use of renewable and non-renewable resources from the normative and positive points of view; evaluation of alternative uses of natural environments; irreversibilities, discounting and intergenerational transfers. Discussion of natural resource problems and policies.

ECON 790 Advanced Urban Economics (3)
Market processes and public policies as related to urban problems and metropolitan change. Employment, housing, discrimination, transportation and the local public sector.

ECON 792 Regional and Urban Economics (3)
Theoretical and empirical analysis of the location and spatial distribution of economic activity. Analysis of regional growth and development. The study of analytical methods and forecasting models.

ECON 799 Master's Thesis Research (1-6)

ECON 808 Workshop on Macroeconomics and Growth (3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs.

ECON 828 Workshop in Econometrics (3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs.

ECON 848 Workshop in International Development, and Comparative Economics (3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs.

ECON 858 Workshop in Public Economics (3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs.

ECON 868 Workshop in Industrial Organization (3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs.

ECON 878 Workshop in Labor Economics (3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs.

ECON 899 Doctoral Dissertation Research (1-8)

EDCI – Curriculum and Instruction

EDCI 401 Student Teaching in Elementary School: Art (4-8)
Prerequisite: EDCI 300. Limited to art education majors who have previously applied. Fulfills elementary teaching requirements in K-12 art education program.

EDCI 402 Student Teaching in Secondary Schools: Art (2-8)
Prerequisite: EDCI 300.

EDCI 403 Teaching of Art Criticism in Public Schools (3)
Introduction to theories of art criticism. Trips to galleries and museums. Open to fine arts majors and students from other disciplines.

EDCI 406 Practicum in Art Education: Two-Dimensional (3)
Prerequisite: permission of department. Theory and practical experience in two-dimensional design in various art media; development of teaching procedures and presentation of materials in school settings.

EDCI 407 Practicum in Art Education: Three-Dimensional (3)
For pre-art education and art education majors only. A lecture-studio course to develop skills, material resources, and educational strategies for three-dimensional projects in school settings.

EDCI 410 The Child and the Curriculum: Early Childhood (3)
Relationship of the nursery school curriculum to child growth and development. Recent trends in curriculum organization; the effect of environment on learning; readiness to learn; and adapting curriculum content and methods to maturity levels of children. Primarily for in-service teachers, nursery school through grade 3.

EDCI 411 Student Teaching: Preschool (4)
For EDCI majors only.

EDCI 412 Student Teaching: Kindergarten (4)
For EDCI majors only.

EDCI 413 Student Teaching: Primary Grades (8)
For EDCI majors only.

EDCI 416 Mainstreaming in Early Childhood Educational Settings (3)
Theoretical bases and applied practices for integrating handicapped children into regular early childhood programs.

EDCI 420 Student Teaching Seminar in Secondary Education: Social Studies (3)
Corequisite: EDCI 421 or EDCI 422. An analysis of teaching theory, strategies, and techniques in the student teaching experience.

EDCI 421 Student Teaching in Secondary Schools: Social Studies/History (12)
Prerequisite: EDCI 320. Corequisite: EDCI 420.

EDCI 422 Student Teaching in Secondary Schools: Social Studies/Geography (12)
Prerequisite: EDCI 321. Corequisite: EDCI 420.

EDCI 423 Social Studies in Early Childhood Education (3)
Curriculum, organization and methods of teaching, evaluation of materials and utilization of environmental resources. Emphasis on multicultural education. Primarily for in-service teachers, nursery school through grade 3.

EDCI 424 Social Studies in the Elementary School (3)
Curriculum, organization and methods of teaching, evaluation of materials and utilization of environmental resources. Emphasis on multicultural education. Primarily for in-service teachers, grades 1-6.

EDCI 425 Social Studies and Multicultural Education (3)
Seminar in general social science principles applicable to multicultural education. Cultural experiences arranged for each participant.

EDCI 426 Methods of Teaching Social Studies in Secondary Schools (3)
Prerequisites: EDHD 300; and EDCI 390. Objectives, selection and organization of subject matter, appropriate methods, lesson plans, textbooks and other instructional materials, measurement and topics pertinent to social studies education. Includes emphasis on multicultural education. For in-service teachers.

EDCI 430 Student Teaching Seminar in Secondary Education: Foreign Language (3)
Prerequisite: EDCI 330. Corequisite: EDCI 431. An analysis of teaching theory, strategies and techniques in the student teaching experience.

EDCI 431 Student Teaching in Secondary Schools: Foreign Language (12)
Prerequisite: EDCI 330. Corequisite: EDCI 430.

EDCI 432 Foreign Language Methods in the Elementary School (3)
Prerequisite: permission of department. Methods and techniques for developmental approach to the teaching of modern foreign languages in elementary schools. Development of oral-aural skills in language development.

EDCI 433 Introduction to Foreign Language Methods (3)
Prerequisites: EDHD 300; and EDCI 390; or permission of department. Objectives, selection and organization of subject matter, appropriate methods, lesson plans, textbooks and other instructional materials, measurement and topics pertinent to foreign language education. For in-service teachers.

EDCI 434 Methods of Teaching English to Speakers of Other Languages (3)
Methods for teaching listening, speaking, reading and writing techniques and a review of research findings.

EDCI 435 Teaching Reading in a Second Language (3)
Prerequisite: permission of department. Analysis of selected theories and practices in first language reading applied to second language teaching/learning; diagnostic and prescriptive techniques and analysis of the student's cultural background as a factor in evaluating reading achievement in the second language.

EDCI 436 Teaching for Multicultural Understanding (3)
Prerequisite: permission of department. The techniques and content for teaching culture in foreign language classes and English as a Second Language (ESL) classes. Research and evaluation of selected aspects of a culture as basis for creating teaching materials.

EDCI 437 Bilingual-Bicultural Education (3)
Prerequisite: permission of department. Analysis of bilingual-bicultural education in the U.S. and abroad with emphasis on TESOL. Methods of teaching, goals, instructional materials and mainstreaming of bilingual students.

EDCI 438 Field Experience in TESOL (3)
Prerequisites: EDCI 434 or equivalent; and permission of department. Systematic observations, tutoring and teaching in a TESOL field setting.

EDCI 440 Student Teaching Seminar in Secondary Education: English, Speech, Theatre (1)
Prerequisite: EDCI 340. Corequisite: EDCI 441. An analysis of teaching theory, strategies and techniques in relation to the student teaching experience.

EDCI 441 Student Teaching in Secondary Schools: English (6-12)
Prerequisite: EDCI 340 or EDCI 442 or EDCI 448. Corequisite: EDCI 440.

EDCI 442 Student Teaching in Secondary Schools: Speech (6-12)
Prerequisite: EDCI 340. Corequisite: EDCI 440.

EDCI 443 Literature for Children and Youth (3)
For elementary education and pre-elementary education majors only. Analysis of literary materials for children and youth. Timeless and ageless books, and outstanding examples of contemporary publishing. Evaluation of the contributions of individual authors, illustrators and children's book awards.

EDCI 444 Language Arts in Early Childhood Education (3)
Teaching of spelling, handwriting, oral and written expression and creative expression. Primarily for in-service teachers, nursery school through grade 3.

EDCI 445 Language Arts in the Elementary School (3)
Teaching of spelling, handwriting, oral and written expression and creative expression. Primarily for in-service teachers, grades 1-6.

EDCI 446 Methods of Teaching English, Speech, Theatre in Secondary Schools (3)
Prerequisites: EDHD 300; and EDCI 390; or permission of department. Objectives, selection and organization of subject matter, appropriate methods, lesson plans, textbooks and other instructional materials, measurement and topics pertinent to English, speech, and drama education. For in-service teachers.

EDCI 447 Field Experience in English, Speech, Theatre Teaching (1)
Corequisite: EDCI 340. Practical experience as an aide to a regular English, Speech or Drama teacher; assigned responsibilities and participation in a variety of teaching/learning activities.

EDCI 448 Student Teaching in Secondary Schools: Theatre (6-12)
Prerequisite: EDCI 340. Persons student teaching in theatre only should register for 12 credits. Persons in the Theatre and English Education Program should register for 6 credits of EDCI 441 and 6 credits of EDCI 448.

EDCI 450 Student Teaching Seminar in Secondary Education: Mathematics (3)
Corequisite: EDCI 451. An analysis of teaching theory, strategies and techniques in the student teaching experience.

EDCI 451 Student Teaching in Secondary Schools: Mathematics (12)
Prerequisite: EDCI 350.

EDCI 452 Mathematics in Early Childhood Education (3)
Prerequisite: MATH 210 or equivalent. Emphasis on materials and procedures which help pupils sense arithmetic meanings and relationships. Primarily for in-service teachers, nursery school through grade 3.

EDCI 453 Mathematics in the Elementary School (3)
Prerequisite: MATH 210 or equivalent. Emphasis on materials and procedures which help pupils sense arithmetic meanings and relationships. Primarily for in-service teachers, grades 1-6.

EDCI 455 Methods of Teaching Mathematics in Secondary Schools (3)
Prerequisites: EDHD 300; and EDCI 390; and 2 semesters of calculus. Objectives, selection and organization of subject matter, appropriate methods, lesson plans, textbooks and other instructional materials, measurement, and topics pertinent to mathematics education.

EDCI 456 Teaching Mathematics to the Educationally Handicapped (3)
Prerequisites: [EDSP 331; and EDSP 332; and EDSP 333; and EDSP 443; and MATH 210] or permission of department. Development of skills in diagnosing and identifying learning disabilities in mathematics and planning for individualized instruction. Clinic participation required.

EDCI 457 Teaching Secondary Students with Difficulties in Learning Mathematics (3)
Corequisite: EDCI 390 or permission of department. Diagnosis, prescription and implementation of instruction for less able secondary school mathematics students. Participation in a clinical experience.

EDCI 461 Reading in Early Childhood Education (3)
Fundamentals of developmental reading instruction, including reading readiness, use of experience stories, procedures in using basal readers, the improvement of comprehension, word analysis, and procedures for determining individual needs. Primarily for in-service teachers, nursery school through grade 3.

EDCI 462 Reading in the Elementary School (3)
Fundamentals of developmental reading instruction, including reading readiness, use of experience stories, procedures in using basal readers, the improvement of comprehension, word analysis, and procedures for determining individual needs. Primarily for in-service teachers, grades 1-8.

EDCI 463 The Teaching of Reading in the Secondary School (3)
The fundamentals of secondary reading instruction, including emphasis on content reading instruction.

EDCI 464 Clinical Practices in Reading Diagnosis and Instruction (3)
Prerequisite: EDCI 362 or EDCI 463. A laboratory course in which each student has one or more pupils for analysis and instruction. At least one class meeting per week to diagnose individual cases and to plan instruction.

EDCI 465 Language, Culture, and Education (3)
Prerequisite: LING 200 or permission of department. Survey of sociolinguistic and psycholinguistic perspectives for the study of language and education; examines pragmatics, speech act theory, and dimensions of language variation (dialects, codes, and registers); implications for educational research and instructional practice.

EDCI 466 Literature for Adolescents (3)
Reading and analysis of fiction and nonfiction; methods for critically assessing quality and appeal; current theory and methods of instruction; research on response to literature; curriculum design and selection of books.

EDCI 467 Teaching Writing (3)
Sources and procedures for developing curriculum objectives and materials for teaching written composition; prewriting, composing, and revision procedures; contemporary directions in rhetorical theory; survey of research on composition instruction.

EDCI 471 Student Teaching in Secondary Schools: Science (12)
Prerequisite: EDCI 352.

EDCI 472 Methods of Teaching Science in Secondary Schools (3)
Prerequisites: EDHD 300; and EDCI 390; and permission of department. Methods for classroom and laboratory instruction, determining appropriate teaching methods, selecting instructional materials, evaluating student achievement. Includes lab and field experience. For in-service teachers.

EDCI 473 Environmental Education (3)
Two hours of lecture and three hours of laboratory per week. An interdisciplinary course covering the literature, techniques and strategies of environmental education.

EDCI 474 Science in Early Childhood Education (3)
Objectives, methods, materials and activities for teaching science in the elementary school. Primarily for in-service teachers, nursery school through grade 3.

EDCI 475 Science in the Elementary School (3)
Objectives, methods, materials, and activities for teaching science in the elementary school. Primarily for in-service teachers, grades 1-6.

EDCI 476 Teaching Ecology and Natural History (3)
An introduction to the teaching of natural history in the classroom and in the field. Ecological principles; resources and instructional materials; curricular materials. Primarily for teachers, park naturalists, and outdoor educators.

EDCI 480 The Child and the Curriculum: Elementary (3)
Relationship of the school curriculum, grades 1-6, to child growth and development. Recent trends in curriculum organization; the effect of environment on learning; readiness to learn; and adapting curriculum content and methods to maturity levels of children. Primarily for in-service teachers, grades 1-6.

EDCI 481 Student Teaching: Elementary (12)
For EDCI majors only.

EDCI 484 Student Teaching in Elementary School: Music (4-6)
For EDCI majors only. Fulfills elementary teaching requirements in K-12 music education programs.

EDCI 485 Student Teaching in Elementary School: Physical Education (4-8)
For EDCI majors only. Fulfills elementary teaching requirements in K-12 physical education programs.

EDCI 487 Introduction to Computers in Instructional Settings (3)
Prerequisite: six hours of education or permission of department. A first-level survey of instructional uses of computers, software, and related technology especially for in-service teachers.

EDCI 488 Selected Topics in Teacher Education (1-3)
Prerequisite: EDCI major or permission of department. Repeatable to 6 credits if content differs.

EDCI 489 Field Experiences in Education (1-4)
Prerequisite: permission of department. Corequisite: EDCI 497. Repeatable to 4 credits.

EDCI 491 Student Teaching in Secondary Schools: Health (12)
For EDCI majors only.

EDCI 494 Student Teaching in Secondary Schools: Music (2-8)
For EDCI majors only.

EDCI 495 Student Teaching in Secondary Schools: Physical Education (2-8)
For EDCI majors only.

EDCI 497 The Study of Teaching (3)
Prerequisite: EDCI 481. Corequisite: EDCI 489. Identification and examination of learner and teacher outcome variables related to teaching systems, methods, and processes. Methods of conducting classroom research.

EDCI 498 Special Problems in Teacher Education (1-6)
Prerequisite: permission of department. For EDCI majors only. Repeatable to 6 credits. Individual study of approved problems.

EDCI 499 Workshops, Clinics, and Institutes (1-6)
Repeatable to 6 credits. The following types of educational enterprise may be scheduled under this course heading: workshops conducted by the College of Education (or developed cooperatively with other colleges and universities) and not otherwise covered in the present course listing; clinical experiences in pupil testing centers, reading clinics, speech therapy laboratories, and special education centers; institutes developed around specific topics or problems and intended for designated groups such as school superintendents, principals and supervisors.

EDCI 600 Trends in Art Education Curriculum (3)
Recent developments in art education.

EDCI 601 History of Art Education (3)
Perspective on art education philosophy as viewed through an historical survey.

EDCI 602 The Teaching of Aesthetics in the Public Schools (3)
Critical investigation of art, and curriculum implications.

EDCI 610 Curriculum for Early Childhood Education (3)
Curriculum theory, research and practice in educational settings for infants and children to age eight.

EDCI 611 The Young Child in the Community (3)
Impact of major social and economic trends on young children and on community agencies, commercial enterprises and social experiences.

EDCI 612 Teaching Strategies in Early Childhood Education (3)
Theory and research of teacher-learner interaction. Analysis of planning, organization of learning environments, evaluation of learning, general classroom management, and inter-personal relationships.

EDCI 613 Teacher-Parent Relationships (3)
Research in parental involvement in school activities and processes.

EDCI 614 Intellectual and Creative Experiences in Early Childhood Education (3)
A critical examination of theories of intellectual and creative development, language development, problem solving and critical thinking.

EDCI 620 Trends in Secondary School Curriculum: Social Studies (3)
Recent developments in educational thinking and practice on the curriculum in social studies.

EDCI 621 Trends in Secondary School Curriculum: Geography (3)
Recent developments in educational thinking and practice on the curriculum in geography.

EDCI 622 Teaching Social Studies in Elementary Schools (3)
Examination of current literature and research in the social sciences as they relate to social studies curriculum and instruction.

EDCI 630 Trends in Secondary School Curriculum: Foreign Language (3)
Recent developments in educational thinking and practice on the curriculum in foreign language education.

EDCI 631 Testing in the Foreign Language/ESL Classroom (3)
Analysis of standardized and teacher-made FL/ESL tests; emphasis on principles of FL/ESL test construction. Field testing of commercial and teacher-made materials.

EDCI 634 Advanced TESOL Methods (3)
Prerequisite: EDCI 434 or equivalent. Methods of teaching reading, writing, listening and speaking skills. Diagnosis of student skills in English; development of ESOL instructional materials. TESOL research projects.

EDCI 635 Advanced Foreign Language Methods (3)
Prerequisite: EDCI 330, EDCI 443, or permission of department. Theory and implementation of the current methods and curricular trends in the foreign language classroom.

EDCI 637 Advanced Laboratory Practice in Foreign Language/TESOL Education (2-6)
Prerequisites: EDCI 434; and EDCI 634; or permission of department. Supervised internship in TESOL setting.

EDCI 640 Trends in Secondary School Curriculum: English (3)
Recent developments in educational thinking and practice on the curriculum in English education.

EDCI 641 Trends in Secondary School Curriculum: Speech (3)
Recent developments in educational thinking and practice on the curriculum in speech.

EDCI 642 Communications and the School Curriculum (3)
Curriculum development based on communication as the major vehicle for describing the learner's interactions with persons, knowledge, and materials in the classroom and school environment.

EDCI 643 Teaching Language Arts in Elementary Schools (3)
Analysis of current issues, trends, and problems in language-arts instruction.

EDCI 644 Issues and Trends in Children's Literature (3)
Contemporary social conditions and problems, trends in publishing, advertising, censorship, media adaptation, and reading habits.

EDCI 650 Trends in Mathematics Education (3)
Recent developments in educational thinking and practice which have affected the curriculum in mathematics.

EDCI 653 Diagnosis and Treatment of Learning Disabilities in Mathematics I (3)
Prerequisite: EDCI 352 or permission of department. Diagnosis and treatment of disabilities in mathematics. Theoretical models, specific diagnostic and instructional techniques and materials for working with children in both clinical and classroom settings. Clinic hours to be arranged.

EDCI 654 Diagnosis and Treatment of Learning Disabilities in Mathematics II (3)
Prerequisite: EDCI 653 or permission of department. Diagnosis and treatment of severe learning disabilities in elementary school mathematics. Theoretical models, relevant research and specific techniques. Clinic hours to be arranged.

EDCI 657 Diagnosis and Treatment of Secondary Students with Misconceptions of Mathematics (3)
Prerequisite: EDCI 450; and EDCI 451; or permission of department. Research and theory concerning common misconceptions in secondary school mathematics. Participation in a clinical experience.

EDCI 660 Corrective Reading Instruction (3)
Prerequisite: EDCI 362 or EDCI 463 or equivalent. Diagnostic techniques, instructional materials and teaching procedures useful in the regular classroom; appropriate for teachers, supervisors, and administrators.

EDCI 661 Teaching Reading in the Content Areas (3)
Prerequisite: EDCI 362 or EDCI 463. Focus on improving student achievement in content disciplines where reading materials are used as instructional resources.

EDCI 662 Reading Diagnostic Assessment and Prescription (3)
Prerequisite: permission of department. Survey course in reading diagnosis and prescription for graduate students not majoring in reading.

EDCI 663 Teaching Reading in the Elementary School (3)
Implications of current theory and research for the teaching of reading in the elementary school.

EDCI 664 Clinical Assessment in Reading (3)
Prerequisites: EDCI 660; and [EDCI 663 or EDCI 667]. Clinical diagnostic techniques and materials for assessing serious reading difficulties.

EDCI 665 Clinical Remediation of Reading Disabilities (3)
Prerequisites: EDCI 660; and [EDCI 663 or EDCI 667]. Remedial procedures and materials for programs of individual and small group instruction.

EDCI 666 The Role of the Reading Resource Teacher (3)
Prerequisites: [EDCI 663 or EDCI 667]; and EDMS 645. Preparation of reading personnel to function as resource persons to classroom teachers, administrators and the school community.

EDCI 667 Teaching Reading in Secondary Schools (3)
Implications of current theory and research for the teaching of reading in the secondary school.

EDCI 670 Trends in School Curriculum: Science (3)
Recent developments in educational thinking and practice on the curriculum in science education.

EDCI 671 Teaching Science in Elementary Schools (3)
Identification of problems in teaching science. Methods for improving the effectiveness of science education.

EDCI 672 Curriculum Innovations in Early Childhood-Elementary Science Education (3)
Analysis of curricula in early childhood-elementary science.

EDCI 677 Computers in Science Education (3)
Prerequisite: EDCI 487 or equivalent. Current and projected methods by which computers can augment classroom and laboratory-based science instruction in school and non-school settings.

EDCI 680 Trends in Secondary School Curriculum (3)
Recent developments in educational thinking and practice on the curriculum.

EDCI 681 Trends in Elementary School Curriculum (3)
Recent developments in educational thinking and practice which have affected the curriculum in elementary education.

EDCI 683 Implementation of Curricular Specialties (3)
Research methods applied in curriculum implementation; societal values, ethics and responsibilities associated with the implementation of curricular specialties; and personal capabilities to successfully implement curriculum.

EDCI 684 Introduction to Field Methods in School and Community (3)
Application of selected field research methods to problems of professional practice. Students plan and conduct field study utilizing qualitative field techniques.

EDCI 685 Research Methods (3)
The interpretation and conduct of research in curriculum and instruction.

EDCI 686 Competency-Based Curricula in Early Childhood Education (3)
Prerequisite: EDCI 487 or permission of department. Theoretical issues in the use of computers in early childhood education. Applications of elementary computer languages with children including curriculum development, teaching methods, integration of the computer into the classroom and problem solving.

EDCI 687 Applications of Computers in Instructional Settings (3)
Prerequisite: EDCI 487 or permission of department. Review and analysis of instructional software and computer-based learning environments from the standpoint of teaching, learning, and design theories. Integration of instructional and tool software into classroom settings.

EDCI 690 Teaching as a Profession (3)
Prerequisite: permission of department. The profession of teaching and the knowledge base that defines teaching. Current and social issues that affect teaching and learning; role of research and experience in learning to teach.

EDCI 691 Models of Teaching: Theories and Applications (3)
Prerequisite: permission of department. Theory and research on teaching as applied to models of instruction. Practice in developing an initial repertoire of teaching models and in providing thoughtful critique of teaching based on these models.

EDCI 693 Research on Effective Teaching (3)
Prerequisite: permission of department. Survey of the research literature on effective teaching and schools. Observation and analysis of teaching in a variety of school and classroom settings.

EDCI 695 Teaching Science and Social Studies through Environmental Study (3)
For EDCI majors only. Curriculum and instruction for science and social studies within a multicultural and environmental context; analysis of social studies and science curriculum materials; utilization of school and community resources.

EDCI 696 Conducting Research on Teaching (3)
Prerequisite: permission of department. Application of the knowledge base on effective teaching to the analysis and improvement of educational practice. Research methods used in the study of classroom teaching. Design and conduct of an action research project.

EDCI 700 Theory and Research in Art Education (3)
A survey of the research literature; evaluation of research techniques; consideration of relevant instructional curriculum theory; evaluation of modern teaching methods and techniques.

EDCI 701 Theory and Research in Music Education (3)
A survey of the research literature; evaluation of research techniques; consideration of relevant instructional curriculum theory; evaluation of modern teaching methods and techniques.

EDCI 710 Staffing in Early Childhood Programs (3)
For advanced students in early childhood education. Problems involved in administration of faculty and staff in programs for young children.

EDCI 711 Education and Group Care of the Infant and Young Child (3)
Prerequisite: EDMS 645 or permission of department. The historical, theoretical and empirical basis for the group care and education of young children with special emphasis on the child under the age of three.

EDCI 713 Research in Early Childhood Education (3)
Prerequisite: EDMS 645 or permission of department. The design and conduct of research with infants and children to age eight; reviews, evaluations and discussions of significant and relevant early childhood research literature.

EDCI 720 Theory and Research in Social Studies Education (3)
Prerequisites: [EDCI 620 or EDCI 622]; and EDMS 645. A survey of the research literature; evaluation of research techniques; consideration of relevant instructional curriculum theory; evaluation of modern teaching methods and techniques.

EDCI 730 Theory and Research in Foreign Language/ESOL Education (3)
A survey of the research literature; evaluation of research techniques; consideration of relevant instructional curriculum theory; evaluation of modern teaching methods and techniques.

EDCI 731 Advanced Teaching of Reading in a Second Language (3)
Prerequisite: EDCI 435 or equivalent. A survey of research literature and evaluation of research techniques applied in second language teaching/learning.

EDCI 740 Theory and Research in English Education (3)
A survey of the research literature; evaluation of research techniques; consideration of relevant instructional curriculum theory; evaluation of modern teaching methods and techniques.

EDCI 741 Theory and Research in Speech Education (3)
A survey of the research literature; evaluation of research techniques; consideration of relevant instructional curriculum theory; evaluation of modern teaching methods and techniques.

EDCI 745 Theory and Research in Written Communication (3)
Recommended: EDCI 685. Analysis and synthesis of recent theoretical trends in writing research; the reading and critiquing of representative research studies. The study of research methods for conducting disciplined inquiry in written communication.

EDCI 750 Theory and Research in Mathematics Education (3)
Prerequisite: EDCI 650. A survey of the research literature; evaluation of research techniques; consideration of relevant instructional curriculum theory; evaluation of modern teaching methods and techniques.

EDCI 761 Advanced Clinical Practices in Reading Diagnosis (3)
Prerequisite: EDCI 665. Corequisite: EDCI 762. Diagnostic work with children in clinic and school situations. Case report writing and conferences.

EDCI 762 Advanced Clinical Practices in Reading Instruction (3)
Prerequisite: EDCI 665. Corequisite: EDCI 761. Remedial instruction with children in clinic and school situations. Remedial techniques, diagnostic teaching and evaluation.

EDCI 769 Theory and Research in Reading (3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs. Survey of the literature in reading and allied fields, and an examination of current research trends and methodologies.

EDCI 770 Foundations of Science Education (3)
Prerequisite: EDCI 670 or EDCI 671; or permission of department. Development of science education; pre-kindergarten through college; the influences on current and future practices; and the identification and critical analysis of topics in science education.

EDCI 771 Theory and Research in Science Education (3)
Prerequisites: EDCI 770; and EDMS 646; or permission of department. A study of various techniques and paradigms for research in science education, pre-kindergarten through college. Identification and critical analysis of a researchable topic in science education and the development of a proposal.

EDCI 780 Theory and Research on Teaching (3)
Analysis of the interactive process of instruction; preschool through higher education in school and non-school settings; future directions and needed research.

EDCI 783 Theory and Research in Computer Education (3)
Prerequisites: [EDCI 685; and EDCI 687; and EDMS 645] or permission of department. Examination of the current research and theory in the instructional uses of computers, instructional tutoring systems, computer programing environments, computer-based laboratories and problem solving environments in educational settings.

EDCI 787 Computer Courseware Development (3)
Prerequisite: EDCI 687 or permission of department. The theory and practice of designing, creating, and analyzing computer-based instruction and tutoring systems. Advanced programming techniques using BASIC and author languages such as PILOT.

EDCI 788 Selected Topics in Teacher Education (1-3)
Repeatable to 6 credits if content differs. Current topics and issues in teacher education.

EDCI 798 Special Problems in Teacher Education (1-6)
Prerequisite: permission of department. Intended for Masters, AGS, or doctoral students in education who desire to pursue a research problem.

EDCI 799 Master's Thesis Research (1-6)

EDCI 800 Seminar in Art Education (3)

EDCI 810 Seminar in Early Childhood Education (3)

EDCI 820 Seminar in Social Studies Education (3)

EDCI 822 Seminar in Secondary Education (3)

EDCI 830 Seminar in Foreign Language Education (3)

EDCI 840 Seminar in English Education (3)

EDCI 841 Seminar in Speech Education (3)

EDCI 858 Seminar in Mathematics Education (1-3)
Repeatable to 6 credits. Survey and analysis of literature on an identified research topic in mathematics education. Design and implementation of a research study to investigate the identified topic.

EDCI 860 Seminar in Reading Education (3)

EDCI 861 Research Methods in Reading (3)
Prerequisites: [EDCI 769; and EDMS 646] or permission of department. Current research questions and methods culminating in a study suitable for submission to journals. Emphasis on using and conducting research.

EDCI 870 Seminar in Science Education (3)

EDCI 880 Doctoral Proposal Seminar (3)
Prerequisites: EDCI 685; and EDCI 780; and permission of department. Definition of the problem, development of research design, data collection processes, and writing and critiquing dissertation proposals.

EDCI 881 Seminar in Instructional Computing (3)
Prerequisites: EDCI 685; and EDCI 687; or permission of department. Group and individual participation in the study of theoretical issues of instructional computing.

EDCI 888 Apprenticeship in Education (1-8)
Prerequisite: permission of department. Apprentice practice under professional supervision. Credit not to be granted for experience accrued prior to registration. Open only to degree- and certificate-seeking graduate students.

EDCI 889 Internship in Education (3-8)
Prerequisite: permission of department. Internship experiences with appropriate supervision. Credit not to be granted for experience accrued prior to registration. Open only to students advanced to candidacy for doctoral degree.

EDCI 899 Doctoral Dissertation Research (1-8)

EDCP – Education Counseling and Personnel Services

EDCP 410 Introduction to Counseling and Personnel Services (3)
Overview of counselor functions and skills that lead to effective helping.

EDCP 411 Principles of Mental Health (3)
Prerequisite: nine semester hours in the behavioral sciences or permission of department. Mechanisms involved with personal adjustment, coping skills, and the behaviors that lead to maladjustment.

EDCP 413 Behavior Modification (3)
Knowledge and techniques of intervention in a variety of social situations, including contingency contracting and time out will be acquired.

EDCP 416 Theories of Counseling (3)
An overview and comparison of the major theories of counseling, including an appraisal of their utility and empirical support.

EDCP 417 Group Dynamics and Leadership (3)
Two hours of lecture and two hours of laboratory per week. *Prerequisite: permission of department.* The nature and property of groups, interaction analysis, developmental phases, leadership dynamics and styles, roles of members and interpersonal communications. Laboratory involves experimental based learning.

EDCP 420 Education and Racism (3)
Strategy development for counselors and educators to deal with problems of racism.

EDCP 460 Introduction to Rehabilitation Counseling (3)
Survey of principles and practices involved in the vocational rehabilitation of persons with disabilities.

EDCP 461 Psycho-Social Aspects of Disability (3)
Theory and research concerning disability, with emphasis on crisis theory, loss and mourning, handicapped as a deviant group, sexuality and functional loss, attitude formation, dying process and coping. Implications for counseling and the rehabilitation process.

EDCP 462 The Disabled Person in American Society (3)
Critical examination of the history of legislation and analysis of current policies toward severely physically and mentally disabled persons.

EDCP 470 Introduction to Student Personnel (3)
Prerequisite: permission of department. A systematic analysis of research and theoretical literature on a variety of major problems in the organization and administration of student personnel services in higher education. Included will be discussion of such topics as the student personnel philosophy in education, counseling services, discipline, housing, student activities, financial aid, health, remedial services, etc.

EDCP 489 Field Experiences in Counseling and Personnel Services (1-4)
Prerequisite: permission of department. Planned field experience in education-related activities. Credit not to be granted for experiences accrued prior to registration.

EDCP 498 Special Problems in Counseling and Personnel Services (1-3)
Prerequisite: permission of department. Available only to major students who have formal plans for individual study of approved problems.

EDCP 499 Workshops, Clinics, Institutes (1-6)
Repeatable to 6 credits. The following type of educational enterprise may be scheduled under this course heading: workshops conducted by the Department of Counseling and Personnel Services (or developed cooperatively with other departments, colleges and universities) and not otherwise covered in the present course listing; clinical experiences in counseling and testing centers, reading clinics, speech therapy laboratories, and special education centers; institutues developed around specific topics or problems and intended for designated groups.

EDCP 605 Issues in Counseling Adults (3)
Theoretical approaches to adult development. The scope and variety of settings (industry, education, government) in which programs of adult counseling and guidance take place, and the nature of such programs.

EDCP 606 Counseling Adults in Transition (3)
Theoretical background for understanding adult transitions such as divorce, promotion, major illness and bereavement. Strategies for helping adult clients cope with major life changes.

EDCP 610 Professional Orientation (3)
Survey of knowledge base and practices in counseling and personnel services specializations, professional ethics, credentialling relevant legislation, current issues.

EDCP 611 Career Development Theory and Programs (3)
Research and theory related to career and educational decisions; programs of related information and other activities in career decision.

EDCP 612 Cross-Cultural Issues in Counseling and Personnel Services (3)
Prerequisites: EDMS 646; and EDCP 616; or permission of department. Socio-psychological, philosophical, clinical, and research topics related to the provision of counseling and personnel services, academic support, and career development for minority students on predominantly white college and university campuses. Implications of race and/or national origin on opportunities for personal, social, academic, and career development in educational settings.

EDCP 614 Personality Theories in Counseling and Personnel Services (3)
Examination of constructs and research relating to major personality theories with emphasis on their significance for working with the behaviors of individuals.

EDCP 615 Counseling I: Appraisal (3)
Corequisite: EDCP 618. For EDCP majors only. Collection and interpretation of appraisal data, synthesis of data through case study procedures. Development of interview skills.

EDCP 616 Counseling II: Theory and Practice (3)
Prerequisite: EDCP 615. Corequisite: EDCP 618. Counseling theories and the practices which stem from such theories.

EDCP 617 Group Counseling (3)
Prerequisite: EDCP 616. A survey of theory, research and practice of group counseling and psychotherapy with an introduction to growth groups and the laboratory approach, therapeutic factors in groups, composition of therapeutic groups, problem clients, therapeutic techniques, research methods, theories, ethics and training of group counselors and therapists.

EDCP 618 Counseling Skills: Introduction to Practicum (1)
Corequisite: EDCP 615 and EDCP 616. Repeatable to 2 credits. Development and utilization of counseling skills.

EDCP 619 Practicum in Counseling (2-6)
Prerequisites: EDCP 616 and permission of department. Sequence of supervised counseling experiences of increasing complexity. Limited to eight applicants in advance. Two hours class plus laboratory.

EDCP 625 Counseling the Chemically Dependent (3)
Chemical dependency and its effects on the individual's personal, social, and work functioning. Counseling procedures for persons with drug and alcohol problems.

EDCP 626 Group Counseling Practicum (3)
Prerequisites: EDCP 617; and EDCP 619; and permission of department. A supervised field experience in group counseling.

EDCP 627 Process Consultation (3)
Graduate course in group process required. Study of case consultation, systems consultation, mental health consultation and the professional's role in systems intervention strategies.

EDCP 633 Diagnostic Appraisal of Children I (3)
Prerequisite: EDCP 726. Corequisite: EDCP 738. Assessment of development, emotional and learning problems of children.

EDCP 634 Diagnostic Appraisal of Children II (3)
Prerequisite: EDCP 633. Corequisite: EDCP 738. Assessment of development, emotional, and learning problems of children.

EDCP 635 Therapeutic Techniques and Classroom Management I (3)
Diagnosis and treatment of problems presented by teachers and parents. Practicum experience.

EDCP 636 Therapeutic Techniques and Classroom Management II (3)
Prerequisite: EDCP 635. Understanding and treatment of children's problems. Focus primarily on the older child in secondary school. Orientation essentially behavioral. Practicum experience provided.

EDCP 655 Organization and Administration of Personnel Services (2)
Prerequisite: EDCP 619 or permission of department. Exploration of personnel services programs and implementing personnel services practices.

EDCP 656 Counseling and Personnel Services Seminar (2)
Examination of issues that bear on professional issues such as ethics, interprofessional relationships and research.

EDCP 662 Medical Aspects of Disability (3)
Prerequisite: EDCP 610 or equivalent. Appraisal of medical aspects in rehabilitation; nature, cause, treatment, limitations, prognosis of most common disabilities; medical terminology; role of the medical specialities.

EDCP 663 Psychiatric Aspects of Disability (3)
Prerequisite: EDCP 610 or permission of department. Part of core curriculum in rehabilitation counseling. The psychiatric rehabilitation client: understanding the client's needs, available treatment approaches and society's reaction to the client.

EDCP 664 Vocational Evaluation (3)
Principles and strategies for the vocational assessment of adult disabled persons. Administration and interpretation of relevant measures.

EDCP 665 Social Support Systems for Counseling (3)
Principles and methods involved in understanding the role of social and environmental support systems in the rehabilitation, school, and community counseling process. Emphasis on the development of specialized skills for working with the impaired adolescent or adult in the home and community context and for mobilizing these resources to support the client.

EDCP 668 Special Topics in Rehabilitation (1-6)
Prerequisite: permission of department. Repeatable to 6 credits if content differs.

EDCP 681 Counseling Adults in the Workplace (3)
Needs and entitlements of employees over the life span and the changing responsibilities of the workplace in meeting these needs. Role of counselors in helping employees and organizations to address these issues.

EDCP 715 Appraisal Measures in Counseling (3)
Prerequisites: EDCP 615 and EDMS 646 or their equivalents. Interpretation and utilization in counseling of the career interest and personality measures.

EDCP 716 Advanced Counseling Theory Seminar (3)
Prerequisite: Master's degree in counseling or permission of department. Systematic investigation of methods of theory analysis and their application to counseling theory.

EDCP 717 Evaluation of Research in Counseling (3)
Prerequisite: permission of department. Research on process and outcome in counseling. A review of research and appropriate research methodologies.

EDCP 718 Advanced Seminar in Group Processes (2-6)
Prerequisite: EDCP 626. Repeatable to 6 credits.

EDCP 726 Practicum in Individual Testing I (3)
Prerequisite: EDMS 622. The administration and interpretation of the Stanford-Binet and Wechsler scales of intelligence.

EDCP 735 Seminar in Rehabilitation Counseling (3)
Part of the core curriculum for rehabilitation counselors. Designed to provide the advanced rehabilitation counseling student with a formal seminar to discuss, evaluate and attempt to reach personal resolution regarding pertinent professional problems and issues in the field.

EDCP 738 Practicum in Child Assessment (1-6)
Corequisite: EDCP 633 or EDCP 634. Repeatable to 6 credits. Administration of complete test batteries to children; supervision of initial interviews; test administration and scoring; interpretation and synthesis of test battery and interview material; the psychological report; verbal interpretation of test results; and recommendations. Taken initially with EDCP 633; repeated with EDCP 634 in the subsequent semester.

EDCP 771 The College Student (3)
A demographic study of the characteristics of college students as well as a study of their aspirations, values, and purposes.

EDCP 776 Modification of Human Behavior: Laboratory and Practicum (3)
Prerequisite: permission of department. Individual and group supervised introduction to intake and counseling relationships.

EDCP 777 Modification of Human Behavior: Laboratory and Practicum (3)
Prerequisites: EDCP 776 and permission of department. Continuation of EDCP 776. Further experience under direct supervision of more varied forms of counseling relationships.

EDCP 778 Research Proposal Seminar (3)
The development of thesis, dissertation or other research proposals.

EDCP 788 Advanced Practicum (1-6)
Prerequisite: previous practicum experience and permission of department. Individual supervision in one of the following areas: (a) individual counseling, (b) group counseling, (c) consultation, or (d) administration.

EDCP 789 Advanced Topics in Counseling and Personnel Services (1-6)
Repeatable to 6 credits.

EDCP 794 Gender-Related Issues in Counseling (3)
The implications of gender roles and conflicts on the counseling process: philosophical, clinical, and research issues.

EDCP 798 Special Problems in Counseling and Personnel Services (1-6)
Master's AGS, or doctoral candidates who desire to pursue special research problems under the direction of their advisers may register for credit under this number.

EDCP 799 Master's Thesis Research (1-6)
Registration required to the extent of six hours for Master's thesis.

EDCP 888 Apprenticeship in Counseling and Personnel Services (1-8)
Prerequisite: permission of department. Apprentice practice under professional supervision in an area of competence compatible with the student's professional goals. Credit not to be granted for experience accrued prior to registration. Open only to degree- and certificate-seeking graduate students.

EDCP 889 Internship in Counseling and Personnel Services (3-8)
Prerequisite: permission of department. Internship experiences at a professional level of competence in a particular role with appropriate supervision. Credit not to be granted for experience accrued prior to registration. Open only to students advanced to candidacy for doctoral degree.

EDCP 899 Doctoral Dissertation Research (1-8)
Registration required to the extent of 12-18 hours for a Ph.D. Dissertation.

EDHD – Education, Human Development

EDHD 400 Introduction to Gerontology (3)
Multidisciplinary survey of the processes of aging. Physiological changes, cultural forces, and self-processes that bear on quality of life in later years. Field study of programs, institutions for elderly, individual elders, their families and care providers.

EDHD 411 Child Growth and Development (3)
Theoretical approaches to and empirical studies of physical, psychological and social development from conception to puberty. Implications for home, school and community.

EDHD 413 Adolescent Development (3)
Adolescent development, including special problems encountered in contemporary culture. Observational component and individual case study. Does not satisfy requirement for professional teacher education program.

EDHD 416 Scientific Concepts in Human Development (3)
Guided reading and observation of students through the school year. Impact of family, school, society, and peer group on individual. Analysis of field data in terms of behavioral patterns.

EDHD 417 Laboratory in Behavior Analysis (3)
Prerequisite: EDHD 416. Continuation of analysis of field observations; emphasis on cognitive processes, motivation, self-concept, attitudes and values.

EDHD 419 Human Development and Learning in School Settings (3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs. Advanced study of human development and learning in different phases of school program over a period of time.

EDHD 420 Cognitive Development and Learning (3)
Prerequisite: EDHD 300 or EDHD 320 or EDHD 411 or PSYC 355 or PSYC 341 or permission of department. Current developmental theories of cognitive processes such as language, memory, and intelligence and how differences in cognitive level (infancy through adolescence) mediate learning of educational subject matters.

EDHD 445 Guidance of Young Children (3)
Prerequisite: PSYC 100 or EDHD 306 or permission of department. Practical aspects for helping and working with children, drawing on research, clinical studies, and observation. Implications for day care and other public issues.

EDHD 460 Educational Psychology (3)
Prerequisite: PSYC 100 or EDHD 306 or permission of department. Application of psychology to learning processes and theories. Individual differences, measurement, motivation, emotions, intelligence, attitudes, problem solving, thinking and communicating in educational settings. (May not be substituted for EDHD 300 by students in professional teacher education programs.)

EDHD 489 Field Experiences in Education (1-4)
Prerequisite: permission of department. Repeatable to 4 credits. Planned field experience in education-related activities. Credit not to be granted for experiences accrued prior to registration.

EDHD 498 Special Problems in Education (1-3)
Prerequisite: permission of department. Available only to students who have definite plans for individual study of approved problems.

EDHD 499 Workshops, Clinics, and Institutes (1-6)
Repeatable to 6 credits. The following type of educational enterprise may be scheduled under this course heading: workshops conducted by the College of Education (or developed cooperatively with other colleges and universities) and not otherwise covered in the present course listing; clinical experiences in pupil-testing centers, reading clinics, speech therapy laboratories,

and special education centers; institutes developed around specific topics or problems and intended for designated groups such as school superintendents, principals and supervisors.

EDHD 600 Introduction to Human Development and Child Study (3)
An overview of the multidisciplinary, scientific principles which describe human development and behavior and an application of these principles in an analysis of a behavioral record. Techniques of observation, recording, and analysis of human behavior. Emphasis on critiquing and applying research findings.

EDHD 601 Biological Bases of Behavior (3)
Pre- or corequisite: EDHD 600. Emphasizes that understanding human life, growth and behavior depends on understanding the ways in which the body is able to capture, control and expend energy. Application throughout is made to human body processes and implications for understanding and working with people.

EDHD 602 Social Bases of Behavior (3)
The social forces and expectations that influence behavior from infancy through old age and death. The effects of ethnicity, social learning values, attitudes, historical events and mass media on perception and behavior in societal interactions.

EDHD 603 Integrative Bases of Behavior (3)
Prerequisites: EDHD 600 or equivalent; and EDHD 601; and EDHD 602. Analyzes the organized and integrated pattern of feeling, thinking and behaving which emerges from the interaction of basic biological drives and potentials with one's unique experience growing up in a social group.

EDHD 610 Physiological Aspects of Aging (3)
Prerequisite: EDHD 601; and [ZOOL 201 or ZOOL 202 or equivalent] or permission of department. Physiological changes with advancing age including cells and tissues; metabolism; homeostasis; and sensorium, with implications with respect to coping with these changes.

EDHD 613 Advanced Laboratory in Behavior Analysis I (3)
First of a three-hour sequence in the study of behavior. Analysis focuses upon the major forces which shape the development and learning of children and youth.

EDHD 615 Advanced Laboratory in Behavior Analysis II (3)
Prerequisite: EDHD 613 or equivalent. Second of a three-course sequence in the behavior analysis of children and youth focusing on self-developmental and self-adjustive processes.

EDHD 619 Advanced Scientific Concepts in Human Development (3)
Repeatable to 6 credits if content differs. A critical examination of concepts and issues in contemporary culture as these relate to the development and learning of children and youth.

EDHD 620 Aging in the Cultural Context (3)
The factors and forces that affect life quality in the late years. Identification of economic, social and governmental influences in the cultural context that enhance or impede continued growth of the person. Individual projects involving direct field experience.

EDHD 630 Cognitive Processes During Aging (3)
Cognitive functioning of the aged. The roles of cultural, environmental and affectional variables as they contribute to the healthy functioning of cognitive processes. On-site field trips.

EDHD 640 The Adult Learner (3)
Changes in adult learning/cognitive processes and factors that may affect an individual's selection and performance of learning tasks; includes discussion of both theoretical issues and proposed applications of research on adult learning.

EDHD 659 Direct Study of Individuals (3)
Observational techniques to record the behavior of an individual. Procedures to ensure objectivity in data collection. Methods used to analyze, categorize, quantify observational data in research.

EDHD 692 Cognitive Basis of Instruction (3)
Prerequisite: permission of department. Psychological and educational research literature on human cognition, especially as applied to learning and teaching in classroom settings.

EDHD 700 Infant Development (3)
An examination of recent research findings in physical, social, emotional and language development during infancy. A review of prenatal and perinatal factors in relation to their influence on later development.

EDHD 701 Training the Parent Educator (3)
Recommended: course in child development. History, philosophy, and ethics of parent education, and examination of issues critical to the design, implementation, and evaluation of parent education programs. Training in communication and leadership skills.

EDHD 710 Affectional Relationships and Processes in Human Development (3)
Pre- or corequisite: EDHD 600 or equivalent. The normal development, expression and influence of love in infancy, childhood, adolescence and adulthood. The influence of parent-child relationship involving normal acceptance, neglect, rejection, inconsistency, and over-protection upon health, learning, emotional behavior and personality adjustment and development.

EDHD 711 Peer-Culture and Group Processes in Human Development (3)
Pre- or corequisite: EDHD 600 or equivalent. The process of group formation, role-taking and status-winning, and the emergence of the peer-culture during childhood and the evolution of the child society at different maturity levels to adulthood. The developmental tasks and adjustment problems associated with winning, belonging, and playing roles in the peer group.

EDHD 721 Learning Theory and the Educative Process I (3)
Major theories, issues and research in learning and cognitive development. Emphasis on the application of these theories to education and the helping professions.

EDHD 722 Learning Theory and the Educative Process II (3)
Prerequisite: EDHD 721 or permission of department. Advanced study of theories, issues and research in several categories of cognition and learning applied to education and the helping professions.

EDHD 730 Field Program in Child Study I (3)
Prerequisite: permission of department. Introductory training and apprenticeship preparing persons to become staff members in human development workshops, consultants in child study field programs and coordinators of municipal or regional child study programs for teachers or parents. Extensive field experience is provided. In general, open only to persons who have passed their preliminary examinations for the doctorate with a major in human development or psychology.

EDHD 731 Field Program in Child Study II (3)
Prerequisite: EDHD 730 or permission of department. Advanced training and apprenticeship preparing persons to become staff members in human development workshops, consultants to child study field programs and coordinators of municipal or regional child study programs for teachers or parents. Extensive field experience is provided. In general, open only to persons who have passed their preliminary examinations for the doctorate with a major in human development or psychology.

EDHD 740 Theories of Conflict Resolution in Human Development (3)
Prerequisite: permission of department. Psychological and sociological theories regarding the nature of human conflict and its resolution and research regarding bargaining and negotiation techniques. Applications to students' professional work.

EDHD 741 Conflict Resolution in Divorce Settlement (3)
Prerequisite: permission of department. Conflict resolution and negotiation techniques to the divorce settlement process. Neutral third party negotiation in conjunction with legal professionals

in resolving issues of child custody and visitation, division of marital property, spousal support, and child support.

EDHD 779 Special Topics in Human Development (1-6)
Prerequisite: permission of department. Repeatable to 6 credits if content differs.

EDHD 780 Research Methods in Human Development (3)
Prerequisite: EDMS 651 or permission of department. Potentials and limitations of empirical observation for contributing to human development knowledge, locating and evaluating relevant human development research, and choosing and applying statistical techniques to human development problems.

EDHD 789 Internship in Human Development (3-8)
Prerequisites: nine credits of human development; and permission of department. Repeatable to 9 credits. Internship experience in one or more human service agencies in the community.

EDHD 798 Special Problems in Education (1-6)
Master's, AGS, or doctoral candidates who desire to pursue special research problems under the direction of their advisors may register for credit under this number.

EDHD 799 Master's Thesis Research (1-6)
Registration required to the extent of six hours for master's thesis.

EDHD 810 Physical Processes in Human Development I (3)
Prerequisite: EDHD 601 or permission of department. Doctoral core course focused on the biological bases of human behavior including physiological processes which have an impact on human development and behavior. Emphasis on theoretical perspectives and identification of research problems.

EDHD 811 Physical Processes in Human Development II (3)
Prerequisite: EDHD 810 or permission of department. Advanced doctoral seminar in the biological bases of behavior with consideration of selected topics introduced in EDHD 810. Identification of research problems and areas of application.

EDHD 820 Socialization Processes in Human Development I (3)
Prerequisite: EDHD 602 or permission of department. Doctoral core course focused on the socialization of human beings. Emphasis on theoretical perspectives from sociology, anthropology, and psychology; examination of the outcomes of socialization.

EDHD 821 Socialization Processes in Human Development II (3)
Prerequisite: EDHD 820 or permission of department. Advanced doctoral seminar on socialization and social development with consideration of selected topics introduced in EDHD 820. Identification of research problems and areas of application.

EDHD 830 Self Processes in Human Development I (3)
Prerequisite: EDHD 603 or permission of department. Doctoral core course focused on personality theories – their history, constructs, and methods; examination of the reciprocal relation between self and the social environment; consideration of different conceptualization of self-processes and related personality research.

EDHD 831 Self Processes in Human Development II (3)
Prerequisite: EDHD 830 or permission of department. Advanced doctoral seminar on current theoretical perspectives in self-processes, with consideration of selected topics introduced in EDHD 830. Identification of research problems and areas of application.

EDHD 860 Synthesis of Human Development Concepts (3)
Prerequisites: EDHD 810; and EDHD 820; and EDHD 830. A seminar for advanced students who work toward a synthesis of their own concepts in human growth and development. Emphasis on seeing the dynamic interrelations among all processes in the behavior and development of an individual.

EDHD 878 Team Research in Human Development (3)
Pre- or corequisite: EDMS 651 or permission of department. Repeatable to 6 credits. Current research literature in human development. Definition of a research problem. Design and implemention of a research study in collaboration with faculty, with completed project presented to colloquium of faculty/students. Must be taken in consecutive fall and spring terms.

EDHD 884 Laboratory in Emotional Development (3)
Prerequisite: EDHD 811 or permission of department. Techniques for measuring emotions in a laboratory setting, including electroencephalography, heart rate measurement, and facial and vocal behavior analysis. For students engaged in research on emotional development of infants and young children.

EDHD 888 Apprenticeship in Education (1-8)
Prerequisite: permission of department. Apprentice practice under professional supervision in an area of competence compatible with the student's professional goals. Credit not to be granted for experience accrued prior to registration. Open only to degree- and certificate-seeking graduate students.

EDHD 889 Internship in Education (3-8)
Prerequisite: permission of department. Internship experiences at a professional level of competence in a particular role with appropriate supervision. Credit not to be granted for experience accrued prior to registration. Open only to students advanced to candidacy for doctoral degree.

EDHD 899 Doctoral Dissertation Research (1-8)
Registration required to the extent of 6-9 hours for an Ed.D. project and 12-18 hours for a Ph.D. dissertation.

EDIT – Industrial, Technological and Occupational Education

EDIT 400 Technology Activities For the Elementary School (3)
Experience in the development and use of technology and career education instructional materials for construction activities in an interdisciplinary approach to elementary school education.

EDIT 401 Essentials of Design (2)
Four hours of laboratory per week. Prerequisite: EDIT 101. A study of the basic principles of design and practice with application to the construction of laboratory projects.

EDIT 402 Methods and Materials in Teaching Bookkeeping and Related Subjects (3)
Problems and procedures in the mastery of bookkeeping and related office knowledge and skills. Consideration of materials and teaching procedures.

EDIT 403 Problems in Teaching Office Skills (3)
Problems in development of occupational competency, achievement tests, standards of achievement, instructional materials, transcription, and the integration of office skills.

EDIT 404 Basic Business Education in the Secondary Schools (3)
Subject matter selection; methods of organization; and presenting business principles, knowledge and practices.

EDIT 405 Business Communications (3)
The fundamental principles of effective written communication. Word usage, grammar, punctuation, principles and procedures for writing business letters, and formal research reports.

EDIT 406 Word Processing (3)
An introduction to the word processing field with emphasis on word processing theory and concepts including hands-on equipment training. Management of office personnel, procedures, and equipment; the incorporation of word processing into the school curriculum, the automated office of the future and career opportunities.

EDIT 410 Administration and Program Development for Industrial Arts and Vocational Education (3)
Principles and practices of program development and supervision with reference to the role of the departmental chairperson in vocational, technical, and industrial arts programs at the secondary and post-secondary levels.

EDIT 412 Management of Physical Facilities in Industrial Arts and Vocational Education (3)
Principles, practices, and theory related to the role of the departmental chairperson charged with the management of the physical facilities in vocational, technical, and industrial arts laboratories.

EDIT 414 Organization and Coordination of Cooperative Education Programs (3)
The organization of a cooperative distributive education program; the development of an effective cooperative relationship between coordinator and training sponsor; the selection, orientation, and training of sponsors; analysis of training opportunities, reports and records; the evaluation and selection of students for part-time cooperative work assignments; and the evaluation of the program.

EDIT 415 Financial and Economic Education I (3)
Problems of teaching courses in personal finance and economics in the public schools, including materials and resources.

EDIT 416 Financial and Economic Education II (3)
Continuation of EDIT 415.

EDIT 421 Industrial Arts in Special Education (3)
One hour of lecture and four hours of laboratory per week. *Prerequisites: [EDSP 470; and EDSP 471] or permission of department.* Experiences of a technical and theoretical nature in industrial processes applicable for classroom use. Emphasis on individual research in the specific area of major interest in special education.

EDIT 422 Student Teaching: Industrial Arts Education (2-12)

EDIT 425 Analysis of Industrial Training Programs I (3)
An overview of the function of industrial training, including methods of instruction, types of programs and their organization, objectives, and evaluation.

EDIT 426 Analysis of Industrial Training Programs II (3)
Prerequisite: EDIT 425. Continuation of EDIT 425. Studies of training programs in a variety of industries, including plant program visitation, training program development, and analysis of industrial training research.

EDIT 427 Experimental Electronics (2)
Six hours of laboratory per week. Student investigation of an area of electronics of particular interest or usefulness at a depth appropriate for student-based objectives relating to one or more of the following: digital circuitry, communication, energy conversion, test equipment utilization, analog circuitry.

EDIT 432 Student Teaching: Business Education (2-12)

EDIT 433 Advanced Topics in Power Technology (3)
Two hours of lecture and four hours of laboratory per week. *Prerequisite: EDIT 233 or equivalent.* The development of a competency in building and evaluating the performance of energy transmission, control and converter systems. Methane digestors, solar collectors, electric motors, steam turbines, and fluid power systems.

EDIT 434 Color Reproduction in Graphic Communications (3)
Two hours of lecture and four hours of laboratory per week. *Prerequisites: [EDIT 234; and EDIT 334; and EDIT 335] or equivalent.* An advanced course in the theory and processes of color graphic reproduction. Continuous tone color photography, flat color preparation, process

color separations and the reproduction of a multi-color product on a semi-automatic or automatic printing press.

EDIT 435 Curriculum Development in Home Economics (3)
An analysis of curriculum development including the tools for planning, managing, and evaluating the teaching/learning environment of conceptual curriculum design.

EDIT 436 Analysis of Child Development Laboratory Practices (3)
Prerequisite: FMCD 332 or EDHD 411. Integration of child development theories with laboratory practices; observation and participation in a secondary school child development laboratory arranged to alternate with class meetings.

EDIT 440 Industrial Hygiene (3)
Introduction to the concept of industrial hygiene and environmental health. Evaluation techniques, instrumentation for identification of problems; design parameters for achieving control over environmental epidemiological and toxicological hazards.

EDIT 442 Student Teaching: Home Economics Education (2-12)

EDIT 443 Industrial Safety I (3)
The history and development of effective safety programs in modern industry including causes, effects and values of industrial safety education including fire prevention and hazard controls.

EDIT 444 Industrial Safety II (3)
Study of exemplary safety practices through conference discussions, group demonstration, and organized plant visits to selected industrial situations. Methods of fire precautions and safety practices. Evaluative criteria in safety programs.

EDIT 445 Systems Safety Analysis (3)
The development of systems safety, a review of probability concepts and the application of systems technique to industrial safety problems. Hazard mode and effect, fault free analysis and human factors considerations.

EDIT 450 Training Aids Development (3)
Study of instructional materials, sources and applications; emphasis on principles for making aids useful to laboratory teachers. Actual construction and application of materials will be required.

EDIT 451 Research and Experimentation in Industrial Arts (3)
A laboratory-seminar course designed to develop persons capable of planning, directing and evaluating effective research and experimentation procedures with the materials, products and processes of industry.

EDIT 453 Fire Safety Research and Transfer (3)
The technological transfer of scientific findings to private sector fire safety. Review of research applicable to the adequacy and reliability of fire safety in industry.

EDIT 454 Private Fire Protection Analysis I (3)
Risk analysis, life safety and property conservation from fire in industrial properties and complexes. Emphasis on a systems approach for implementing private fire protection.

EDIT 455 Private Fire Protection Analysis II (3)
Prerequisite: EDIT 448. Internal property detection and fire suppression systems that can mitigate a fire in the incipient stage. Review of systems, with emphasis on the performance objectives of preventing, controlling, and extinguishing fires.

EDIT 457 Tests and Measurements (3)
The construction of objective tests for occupational and vocational subjects. Use of measures in domains of learning and examination of test analysis techniques.

EDIT 460 Design Illustrating II (2)
Four hours of laboratory per week. *Prerequisite: EDIT 160.* Advanced drawing, rendering, shadow construction, lettering techniques and advanced pictorial representation techniques.

EDIT 461 Principles of Vocational Guidance (3)
The underlying principles of guidance and their application to the problems of educational and occupational adjustment of students of all ages.

EDIT 462 Occupational Analysis and Course Construction (3)
Application of the techniques of occupational and job analysis concepts to instructional development and the design of occupational programs.

EDIT 464 Laboratory Organization and Management (3)
The basic elements of organizing and managing an industrial education program, the selection of equipment, facility development, legal responsibilities of laboratory instructors, inventory, storage control and safety.

EDIT 465 Modern Industry (3)
The manufacturing, service, and extractive industries in American social, economic, and cultural patterns. Representative basic industries studied from the viewpoints of personnel and management organization, industrial relations, production procedures, distribution of products, etc.

EDIT 466 Educational Foundations of Industrial Arts (3)
A study of the factors which place industrial arts education in a well-rounded program of general education.

EDIT 467 Problems in Occupational Education (3)
The procurement, assembly, organization, and interpretation of data relative to the scope, character and effectiveness of occupational education.

EDIT 470 Numerical Control in Manufacturing (3)
The historical development of numerical control (N/C) in manufacturing, recent industrial trends in N/C, and a variety of N/C equipment and support services. N/C machine operations: machine motions, positioning control systems, N/C tapes and their preparation, manual and computer assisted (APT III) part programming. Experience in product design, part programming, and product machining.

EDIT 471 History and Principles of Vocational Education (3)
The development of vocational education from primitive times to the present with special emphasis given to the vocational education movement with the American program of public education.

EDIT 472 Quality Control and Assurance in Industrial Settings (3)
Principles and theory of quality control and assurance, with focus on "quality of conformance." Organizational aspects of QC/QA, data collection and analysis, quality control in input, process and output functions, and human and cultural dimensions of quality control.

EDIT 474 Organization and Administration of Youth Groups (3)
Principles, practices, and theoretical considerations related to youth organizations as a co-curricular function of the subject areas of industrial arts, business and marketing education, home economics, health occupations and trades and industry.

EDIT 475 Recent Technological Developments in Products and Processes (3)
Recent technological developments as they pertain to the products and processes of industry. The nature of newer products and processes and their effect upon modern industry and/or society.

EDIT 476 Application of Technology to Societal Problems (3)
A study of alternative solutions of a technological nature with respect to such areas as housing, transportation, energy, communications, production, trash and waste disposal, water development, and pollution control.

EDIT 477 Microcomputer Applications in Technology and Industry (3)
Prerequisite: EDCI 487 or CMSC 103 or permission of department. Manufacturing, safety, and training applications in industrial settings included in programming and software utilization.

EDIT 481 Manufacture and Use of Inorganic Nonmetallic Materials (3)
Two hours of lecture and four hours of laboratory per week. *Prerequisite: EDIT 381 or equivalent.* Fabrication of products from calculated compositions; application of forming process; utilization of compositions; experiences with property analysis and product design.

EDIT 482 Student Teaching: Trade and Industrial Education (2-12)

EDIT 484 – 486 Field Experiences in Vocational Areas.
Supervised work experience in an occupation related to vocational education. Application of theory to work situations as a basis for teaching in vocational education programs. By individual arrangement with advisor.

EDIT 485 Field Experiences in Business Education (3)

EDIT 488 Selected Topics in Education (1-3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs.

EDIT 489 Field Experiences in Education (1-4)
Prerequisite: permission of department. Planned field experience in education-related activities. Credit not to be granted for experiences accrued prior to registration.

EDIT 491 Plastics Design and Equipment Selection (3)
Two hours of lecture and four hours of laboratory per week. *Prerequisite: EDIT 391 or permission of department.* Experience with material selection, product design, mold design, auxiliary equipment and fixtures.

EDIT 492 Issues Encountered in Daily Living in the Home (3)
Junior standing. Addresses issues such as differing values, orientations, communication styles and the integration of family living, work, and parenting.

EDIT 493 Home Economics for Special Need Learners (3)
Mental, emotional, social and physical handicaps affecting learners in home economics education settings. The unique needs and abilities of special learners and methods of teaching daily living skills.

EDIT 498 Special Problems in Education (1-6)
Prerequisite: permission of department. Available only to majors who have definite plans for individual study of approved problems. Credit according to extent of work.

EDIT 499 Workshops, Clinics, and Institutes (1-6)
Repeatable to 6 credits. The following type of educational enterprise may be scheduled under this course heading: Workshops conducted by the College of Education (or developed cooperatively with other colleges and universities) and not otherwise covered in the present course listing; clinical experiences in pupil-testing centers, reading clinics, speech therapy laboratories, and special education centers; institutes developed around specific topics or problems and intended for designated groups such as school superintendents, principals and supervisors.

EDIT 600 Administration and Supervision of Business Education (3)
Major emphasis on departmental organization and its role in the school program, curriculum, equipment, budget-making, supervision, guidance, placement and follow-up, school-community relationships, qualifications and selection of teaching staff, visual aids, and in-service programs for teacher development. For administrators, supervisors, and teachers.

EDIT 605 Principles and Problems of Business Education (3)
Principles, objectives, and practices in business education; occupational foundations; current attitudes of business, labor and school leaders; general business education in relation to consumer business education and to education in general.

EDIT 606 Curriculum Development in Business Education (3)
Study of curriculum planning in business education. Emphasis on the philosophy and objectives of the business education program, and on curriculum research and organization of appropriate course content.

EDIT 607 Philosophy of Industrial Arts Education (3)
An overview of the development of the industrial arts movement and the philosophical framework upon which it was founded. Special emphasis on contemporary movements in industrial arts and their theoretical foundations.

EDIT 614 School Laboratory Planning and Equipment Selection (3)
The principles and problems of providing the physical facilities for industrial education programs. The selection, arrangement and placement of equipment, and the determination of laboratory space requirements, utility services and storage requirements for various types of industrial education programs.

EDIT 616 Supervision of Industrial Arts (3)
The nature and function of the supervisor in the industrial arts field. Administrative and supervisory responsibilities, techniques, practices and personal qualifications of the industrial arts supervisor.

EDIT 620 Organization, Administration and Supervision of Vocational Education (3)
A theoretical and research base for the study of practices in vocational and technical education. Examination of administrative processes.

EDIT 636 Evaluation in Home Economics Education (3)
Construction and use of evaluation processes in home economics programs.

EDIT 640 Research in Industrial Arts and Vocational Education (1-3)
A seminar for students conducting research in industrial arts, vocational education, and industrial technology.

EDIT 641 Content and Method of Industrial Arts (3)
Examination of methods and procedures used in curriculum development. Application of those suited to the field of industrial arts education. Methods and devices for industrial arts instruction.

EDIT 642 Coordination in Work-Experience Programs (3)
Philosophy and practices of cooperative programs. Methods and techniques of coordination in comprehensive and part-time programs.

EDIT 643 Curriculum Trends in Marketing and Distributive Education (3)
Recent developments in educational thinking and practice which have affected the curriculum in distributive education.

EDIT 644 Curriculum Trends in Business Education (3)
Recent developments in educational thinking and practice which have affected the curriculum in business education.

EDIT 647 Seminar in Industrial Arts and Vocational Education (1-3)
A seminar for students conducting and developing research in industrial arts, vocational education, and industrial technology.

EDIT 650 Teacher Education in Industrial Arts (3)
The function and historical development of industrial arts teacher education. Program administration and development, physical facilities and requirements, staff organization and relationships, college-secondary school relationships, philosophy and evaluation.

EDIT 676 Planning and Policy Issues in Vocational and Technical Education (3)
Prerequisite: EDIT 471 or permission of department. Current problems and issues in policy planning, including training, social, and economic functions of vocational and technical education.

Characteristics of youth, adult client populations, training in public, private, domestic and international settings.

EDIT 705 Trends in the Teaching and Supervision of Home Economics Education (3)
Study of home economics programs and practices in light of current educational trends. Interpretation and analysis of democratic teaching procedures, outcomes of instruction, and supervisory practices.

EDIT 742 Theory and Research in Business Education (1-3)
A survey of the research literature; evaluation of research techniques; consideration of relevant instructional curriculum theory; evaluation of modern teaching methods and techniques.

EDIT 746 Theory and Research in Home Economics Education (1-3)
Prerequisite: EDMS 645 or permission of department. A survey of the research literature; evaluation of research techniques; consideration of relevant instructional curriculum theory; evaluation of modern teaching methods and techniques.

EDIT 760 Modes of Inquiry in Industrial and Social Institutions (3)
Modes of inquiry used to conduct research in industrial and social institutions in the interest of human context in these settings. Interpretive and critical science as alternatives to the empirical orientation.

EDIT 780 Leadership Seminar in Vocational Education (3)
Seminar in the contributions of local, state, and national agencies to the formulation of vocational/technical education programs.

EDIT 788 Selected Topics in Education (1-3)
Repeatable to 6 credits if content differs. Current topics and issues in education.

EDIT 798 Special Problems in Education (1-6)
Prerequisite: permission of department. Intended for Master's, AGS, or doctoral students in education who desire to pursue a research problem.

EDIT 799 Master's Thesis Research (1-6)

EDIT 821 Seminar in Business Education (3)

EDIT 826 Seminar in Home Economics Education (3)

EDIT 888 Apprenticeship in Education (1-8)
Prerequisite: permission of department. Apprentice practice under professional supervision in an area of competence compatible with the student's professional goals. Credit not to be granted for experience accrued prior to registration. Open only to degree-and certificate-seeking graduate students.

EDIT 889 Internship in Education (3-8)
Prerequisite: permission of department. Internship experiences at a professional level of competence in a particular role with appropriate supervision. Credit not to be granted for experience accrued prior to registration. Open only to students advanced to candidacy for doctoral degree.

EDIT 899 Doctoral Dissertation Research (1-8)

EDMS – Measurement, Statistics, and Evaluation

EDMS 410 Principles of Testing and Evaluation (3)
Basic principles including the steps in the specification of instructional objectives and subsequent development of teacher-made tests; problems in the use and interpretation of achievement and aptitude tests; introduction to the development and use of non-testing evaluation procedures; basic consideration in the assignment of marks and grades; introduction to computer technology as applied to measurement.

EDMS 451 Introduction to Educational Statistics (3)
Designed as a first course in statistics for students in education. Emphasis is upon educational applications of descriptive statistics, including measures of central tendency, variability and association. Also included are inferential statistics through one-way ANOVA.

EDMS 465 Algorithmic Methods in Educational Research (3)
Introduction to the use of the computer as a tool in educational research. Instruction in a basic scientific computer source language as well as practical experience in program writing for solving statistical and educational research problems.

EDMS 489 Field Experiences in Measurement and Statistics (1-4)
Prerequisite: permission of department. Repeatable to 4 credits. Planned field experience in education-related activities. Credit not to be granted for experiences accrued prior to registration.

EDMS 498 Special Problems in Measurement and Statistics (1-3)
Prerequisite: permission of department. Repeatable to 6 credits. Available only to education majors who have formal plans for individual study of approved problems.

EDMS 622 Theory and Practice of Standardized Testing (3)
Prerequisite: EDMS 451; or EDMS 645. Study of group tests typically employed in school testing programs; discussion of evidence relating to the measurement of abilities; practice in standardized group test administrations.

EDMS 623 Applied Measurement: Issues and Practices (3)
Prerequisite: EDMS 646. Current research and applications in Measurement Theory.

EDMS 626 Measurement Techniques For Research (3)
Prerequisite: EDMS 646. Theory, development and applications of various measurement instruments and procedures. Questionnaires, interviews, rating scales, attitude scales, observational procedures, ecological approaches, Q-sort, semantic-differential, sociometry and other techniques.

EDMS 635 Computer-Based Measurement (3)
Prerequisite: EDMS 651; and EDMS 623. Theory and technological developments in computer-based measurement, including computer adaptive testing, instructional testing, item banking, applications to non-cognitive measures, as well as comparisons to traditional methods.

EDMS 645 Quantitative Research Methods I (3)
Introduction to research design principles and the scientific method as applied to behavioral phenomena. Instrumentation procedures including the planning and construction of simple data collection instruments and their analysis, and assessment of the reliability and validity of such instruments. Statistical procedures appropriate to the analysis of data from simple research designs. Laboratory experiences in instrumentation and research design are emphasized.

EDMS 646 Quantitative Research Methods II (3)
Prerequisite: EDMS 645. Special problems arising in the implementation of educational research designs. Instrumentation to measure attitudes and collection of questionnaire data. Additional statistical procedures appropriate to the analysis of education research designs. Laboratory experiences in instrumentation and research design are emphasized.

EDMS 647 Introduction to Evaluation Models (3)
Prerequisite: EDMS 646 or equivalent. Explores the principal approaches to evaluation research.

EDMS 651 Intermediate Statistics in Education (3)
Distributional theory; Chi-square analysis of contingency tables; analysis of variance; introduction to multiple correlation and regression.

EDMS 653 Correlation and Regression Analysis (3)
Prerequisite: EDMS 651. Systematic development of simple regression, multiple regression, and non-linear regression as applied to educational research problems. Emphasis is on underlying theory of procedures and on analytical approaches which are amenable to computerization.

EDMS 657 Factor Analysis (3)
Prerequisite: EDMS 651. Development of models for factor analysis and their practical applications. Treatment of factor extraction, rotation, second-order factor analysis, and factor scores. Introduction to linear structural relations models.

EDMS 723 Measurement Theory I (3)
Prerequisites: EDMS 623; and EDMS 651. Theoretical development of the fundamentals of measurement.

EDMS 724 Measurement Theory II (3)
Theoretical formulations of measurement such as latent class and item response models.

EDMS 738 Seminar in Special Problems in Measurement (1-3)
Prerequisite: permission of department. Repeatable to 3 credits. An opportunity for students with special interests to focus in depth on contemporary topics in measurement. Topics to be announced, but will typically be related to applied and theoretical measurement.

EDMS 747 Design of Program Evaluations (3)
Prerequisites: EDMS 626; and EDMS 647; and EDMS 651 or permission of both department and instructor. Analysis of measurement and design problems in program evaluations.

EDMS 769 Special Topics in Applied Statistics in Education (1-4)
Prerequisite: permission of department. Designed primarily for students majoring or minoring in measurement, statistics or evaluation.

EDMS 771 Design of Experiments (3)
Prerequisite: EDMS 651. Major types of statistical designs; application of multivariate statistical techniques; introduction to log linear models.

EDMS 779 Seminar in Applied Statistics (1-3)
Repeatable to 3 credits. Enrollment restricted to doctoral students with a major or minor in measurement, statistics or evaluation. Seminar topics will be chosen by individual student interest.

EDMS 780 Research Methods and Materials (3)
Research methodology for case studies, surveys, and experiments; measurements and statistical techniques. Primarily for advanced students and doctoral candidates.

EDMS 798 Special Problems in Education (1-6)
Master's, AGS, or doctoral candidates who desire to pursue special research problems under the direction of their advisors may register for credit under this number.

EDMS 799 Master's Thesis Research (1-6)
Registration required to the extent of 6 credits.

EDMS 879 Doctoral Seminar (1-3)
Prerequisite: permission of department. Analysis of doctoral projects and theses, and of other on-going research projects. Doctoral candidates may participate in the seminar during as many university sessions as they desire, but may earn no more than three semester hours of credit accumulated one hour at a time in the seminar. A Ph.D. candidate may repeat to a combined maximum of eighteen credits in the seminar and in EDMS 899.

EDMS 889 Internship in Measurement and Statistics (3-12)
Prerequisite: permission of department. Provides internship experiences at a professional level of competence in a particular role with appropriate supervision. Credit not to be granted for experience accrued prior to registration. Open only to students advanced to candidacy for doctoral degree.

EDMS 899 Doctoral Dissertation Research (1-8)
Registration required to the extent of 12-18 credits.

EDPA – Education Policy, Planning and Administration

EDPA 400 The Future of the Human Community (3)
Examination of the future of our social and cultural institutions for education and child rearing, social and family relationships, health and leisure, information exchange, and the provision of food, clothing, and shelter.

EDPA 401 Educational Technology, Policy, and Social Change (3)
Junior standing. Examines technology as a complex force which influences social change and the educational development of individuals.

EDPA 412 Logic of Teaching (3)
An analysis of the structure of basic subject matters in the curriculum and of the standard logical moves in teaching.

EDPA 440 Educational Media (3)
Survey of classroom uses of instructional media. Techniques for integrating media into instruction. Includes preparation of a unit of instruction utilizing professional and teacher produced media.

EDPA 471 The Legal Rights and Obligations of Teachers and Students (3)
Selected state and federal court decisions, legislation, and executive guidelines regulating public education: speech and other forms of expression, privacy, suspensions, expulsions, search and seizure, tort liability for negligence (including education malpractice), hiring, promotion, dismissal and non-renewal of teachers. No prior legal training required.

EDPA 488 Special Topics in Education Policy and Administration (1-3)
Prerequisite: permission of department. Repeatable to 6 credits. Special and intensive treatment of current topics and issues in education policy and administration.

EDPA 489 Field Experiences in Education (1-4)
Prerequisite: permission of department. Planned field experience in education-related activities. Credit not to be granted for experiences accrued prior to registration.

EDPA 498 Special Problems in Education (1-3)
Prerequisite: permission of department. Available only to students who have definite plans for individual study of approved problems.

EDPA 499 Workshops, Clinics, and Institutes (1-6)
Repeatable to 6 credits. The following type of educational enterprise may be scheduled under this course heading: Workshops conducted by the College of Education (or developed cooperatively with other colleges and universities) and not otherwise covered in the present course listing; clinical experiences in pupil-testing centers, reading clinics, speech therapy laboratories, and special education centers; institutes developed around specific topics or problems and intended for designated groups such as school superintendents, principals and supervisors.

EDPA 601 Contemporary Social Issues in Education (3)
Theoretical and practical consideration of vital social issues currently affecting education.

EDPA 605 Comparative Education (3)
Analyzes and compares leading issues in education in various countries of the world, particularly as they relate to crucial problems in American education.

EDPA 610 History of Western Education (3)
Educational institutions through the ancient, medieval and early modern periods in western civilization, as seen against a background of socio-economic development.

EDPA 611 History of Education in the United States (3)
A study of the origins and development of education in the United States, emphasizing the variety of interpretive and methodological concerns that define the field.

EDPA 612 Philosophy of Education (3)
A study of the great educational philosophers and systems of thought affecting the development of modern education, with particular emphasis on recent scholarship on philosophical problems in education.

EDPA 613 Educational Sociology (3)
The sociological study of education as an evolving set of methods and procedures, and body of knowledge. Focuses on several major theoretical perspectives used by sociologists studying education.

EDPA 614 Politics of Education (3)
Educational institutions as political entities with an emphasis on their relationships with federal, state, and local governments as well as with interest groups. The application of competing models of the political process to the passing of laws, development of budgets, and the control of the formulation, implementation, and evaluation of education policies.

EDPA 620 Education Policy Analysis (3)
Policy making in education from planning to evaluation with emphasis on the identification of policy problems and the resources available to analysts through multi-disciplinary approaches. An introductory experience with education policy analysis.

EDPA 621 Decision Making and Education Policy (3)
Prerequisite: EDPA 620. Organizational decision processes and policy formation within educational organizations – schools, colleges, universities, government agencies and industry.

EDPA 622 Education Policy, Values, and Social Change (3)
Prerequisite: EDPA 620. Examination of relationships among educational policy, values, and social change. Roles of educational organizations and institutional change in such social issues as equity and cultural diversity.

EDPA 623 Education Policy and Theories of Change (3)
Prerequisite: EDPA 620. The work of change theorists in history, economics, political science, philosophy, sociology and anthropology as it impinges upon education policy.

EDPA 625 Federal Education Policy (3)
Prerequisite: EDPA 620. Federal involvement in education in the United States from 1780 to the present, emphasizing the effects of legislation, court decisions, agencies, and presidential initiatives on the distribution of education opportunities.

EDPA 626 Education Policy and the Young (3)
The systematic exploration of education policy as it has organized, reflected and influenced the lives of children, youth, and families, with particular emphasis on American policies and systems.

EDPA 627 Education Policy: An International Perspective (3)
An analysis of education policy issues in various parts of the world. Comparisons with the United States. Teachers' organizations and citizen participation in policy determination. Ethnic and racial group pressures and attempts to control education policy.

EDPA 634 The School Curriculum (3)
A foundations course embracing the curriculum as a whole from early childhood through adolescence, including a review of historical developments, an analysis of conditions affecting curriculum change, an examination of issues in curriculum making, and a consideration of current trends in curriculum design.

EDPA 635 Principles of Curriculum Development (3)
Curriculum planning, improvement, and evaluation in the schools; principles for the selection and organization of the content and learning experiences; ways of working in classroom and school on curriculum improvement.

EDPA 636 Communication and the School Curriculum (3)
Curriculum development based on communication as the major vehicle for describing the learner's interactions with persons, knowledge, and materials in the classroom and school environment. (Listed also as EDEL 636.)

EDPA 650 Professional Seminar in Higher and Adult Education (3)
Introduction to higher and adult education as a field of study. Origins, current dimensions and problems, and emerging issues. Field trips to state and national capitols, and involvement in professional conferences.

EDPA 651 Higher Education Law (3)
Selected court opinions, legislation and executive guidelines regulating higher education. First and fourth amendment rights of students and faculty, procedural due process, equal educational opportunity, equal protection in hiring, promotion, non-renewal and salaries, individual and institutional liability for civil rights violations and common law torts. No prior legal training required.

EDPA 652 Higher Education in American Society (3)
Examines the concepts of academic freedom, corporate autonomy and institutional accountability with emphasis on twentieth century relationships between higher education and government in the United States.

EDPA 653 Organization and Administration of Higher Education (3)
Basic concepts and terminology related to organizational behavior and institutional governance structures. The governance and organization of higher education in the United States.

EDPA 654 The Community and Junior College (3)
Historical development and philosophical foundations of community and junior colleges in America with emphasis on organizational and administrative structures in two year institutions and the clientele they serve.

EDPA 655 Administration of Adult and Continuing Education (3)
An overview of the field of Adult/Continuing Education focusing on the administration of institutions and organizations that provide both credit and non-credit educational experiences for adult learners.

EDPA 657 History of Higher Education in the United States (3)
History of higher education in America from colonial times to the present with emphasis on expansion of higher education and the growing complexity of its structures, organization, and purposes.

EDPA 660 Administrative Foundations (3)
Develops a theoretical and research based structure for the study and practice of administration in the field of education.

EDPA 661 Administrative Behavior and Organizational Management (3)
Critical analysis of organizational governance and management (informal and formal dimensions), and of contributions from other fields (traditional and emerging) to the study of administrative behavior.

EDPA 662 Administrative Processes (3)
Develops competence with respect to selected administrative process areas.

EDPA 663 Policy Formulation in Education (3)
Various levels of school governance. Analysis of policy formation, administration and evaluation issues.

EDPA 664 School Surveys (3)
Prerequisite: permission of department. Study of the design, administration and evaluation of school surveys.

EDPA 665 The Organization and Administration of Secondary Schools (3)
Prerequisite: permission of department. The work of the secondary school principal. Includes topics such as personnel problems, school-community relationships, student activities, schedule making, and internal financial accounting.

EDPA 666 Organization and Administration of Elementary Schools (3)
Problems in administering elementary schools and improving instruction.

EDPA 667 Public School Supervision (3)
The nature and functions of supervision; various supervisory techniques and procedures; human relationship factors; and personal qualities for supervision.

EDPA 671 Elementary and Secondary School Law (3)
Selected court opinions, legislation and executive guidelines regulating elementary and secondary education. Equal educational opportunity, first and fourth amendment rights of students and teachers, tort liablity for negligence, equal protection in hiring, firing and non-renewal of teachers, individual and institutional liablity for federal civil rights violations and common law torts. No prior legal training required.

EDPA 673 Collective Bargaining in Elementary-Secondary Education (3)
Evolution and impact of collective bargaining in elementary and secondary education. Impact of collective bargaining on the educational power structure, third-party community interests and education policy making.

EDPA 675 Public School Personnel Administration (3)
A comparison of practices with principles governing the satisfaction of school personnel needs, including a study of tenure, salary schedules, supervision, rewards, and other benefits.

EDPA 676 School Finance and Business Administration (3)
Introduction to principles and practices in the administration of the public school finance activity. Sources of tax revenue, the budget, and the function of finance in the educational program are considered.

EDPA 679 Master's Seminar (3)
Directed study for master's degree students writing seminar papers.

EDPA 690 Research in Education Policy, Planning and Administra tion (3)
Introduction to research methods and designs used in studies of education policy, planning, and administration.

EDPA 700 Qualitative Research Methods in Education (3)
Qualitative methods in education research, emphasizing the paradigms of philosophy, history, sociology, anthropology, and comparative studies as they rely on narrative rather than quantitative ordering of data.

EDPA 705 International Educational Change (3)
Exploration and analysis of major trends in education in several parts of the world, with attention directed to educational change as the outcome of deliberate efforts by nations and international organizations as well as those which occur without central planning or direction.

EDPA 706 Education in Developing Countries (3)
Examination of the development of modern educational systems in Africa, Asia and Latin America out of the colonial and traditional past into the independent present and future. Focus on research on changing philosophies and persistent education problems in these societies.

EDPA 707 Education in the Near East (3)
Current educational problems of the Near East as they have emerged from the confrontation of the traditional Muslim educational heritage with the foreign educational activities and the forces of nationalism and modernization.

EDPA 712 Analysis of Educational Concepts (3)
Analyses of selected concepts used in thinking about education.

EDPA 732 History of Curriculum Theory and Development (3)
Prerequisite: EDPA 635 or permission of department. The writings of major educators in curriculum. Conceptual and formal similarities and differences between current curriculum projects and historical antecedents. Survey of curriculum materials for classroom use in their relationship to the curriculum theory of their time.

EDPA 738 Scholarly Thought and Contemporary Curriculum (1-3)
Prerequisite: permission of department. Repeatable to 6 credits. Current curricular trends, issues, theory, and research in the light of past curricular and social thought.

EDPA 750 International Higher Education (3)
Comparison of higher education systems in several countries, and of the problems and issues in higher education faced by these countries.

EDPA 751 Law and Equity in Education (3)
Prerequisite: EDPA 651 or permission of department. Analysis and evaluation of judicial and executive branch attempts to give operational meaning to federal equity legislation and to develop remedial policies relating to equal educational and employment opportunity in post-secondary education.

EDPA 752 State Systems of Higher Education (3)
Creation, operation, alteration and evaluation of state systems of higher education. Campus autonomy versus public accountability. Analysis of topics such as state planning, budget and program review, and administration of student aid and federal programs.

EDPA 753 Higher Education Planning (3)
Prerequisite: EDPA 653 or permission of department. Social science concepts underlying planning. Applications of planning concepts and techniques to higher education at institutional, state and national levels.

EDPA 754 Higher Education Finance (3)
Economic perspectives on higher education. Ways of financing higher education and current finance issues. Higher education budget concepts and processes.

EDPA 755 Federal Policies in Post-Secondary Education (3)
Evolution of the federal role, its current scope and funding. Policy issues associated with federal student aid programs, research grants and social equity regulations.

EDPA 756 Curriculum in Higher Education (3)
Conditions affecting curriculum change in higher education, including critical analysis of various bases for the college curriculum in the context of college and university life.

EDPA 757 College Teaching (3)
Critical review of literature on teaching in higher education from conceptual and practical viewpoints. Designed for current and prospective adult educators. Focused on research and improvement of instruction.

EDPA 759 Seminar in Adult and Continuing Education (3)
Current issues and problems in adult and continuing education and lifelong learning in America.

EDPA 760 The Human Dimension in Administration (3)
Prerequisite: EDPA 660 or permission of department. Theory, research findings, and laboratory experiences in human skills in organizations.

EDPA 761 Group Relationships in Administration (3)
Prerequisite: EDPA 660 or permission of department. Group relationships and relevant administrative skills in educational settings. The role of authority, group maturation, group member roles, group decision-making, and intra-group and inter-group conflict.

EDPA 767 The Effective Principal (3)
Prerequisite: EDPA 665 or EDPA 666. Research on school principal effectiveness emphasizing conditions of and methodologies for assessing principal/school effectiveness.

EDPA 772 Practicum in Leadership Behaviors (3)
Prerequisites: EDPA 660 and EDPA 661, or permission of department. Practicum in the use of social exchange behaviors in administrative/leadersh ip situations. Emphasis on development and refinement of exchange behaviors enhancing employee commitment and productivity in human service organizations.

EDPA 788 Special Topics in Education Policy and Administration (1-3)
Prerequisite: permission of department. Repeatable to 6 credits. Special and intensive treatment of current topics and issues in education policy and administration.

EDPA 798 Special Problems in Education (1-6)
Master's, AGS, or doctoral candidates who desire to pursue special research problems under the direction of their advisors may register for credit under this number.

EDPA 799 Master's Thesis Research (1-6)
Registration required to the extent of six hours for master's thesis.

EDPA 805 Seminar in Comparative Education (3)
Analysis of educational issues on a worldwide basis with opportunities to focus on a particular country on an individual basis. Analysis of qualitative research methods as used in cross-cultural and comparative education studies.

EDPA 809 Intermediate Research Methods (3)
Specific methodologies employed in educational studies.

EDPA 811 Seminar in History of Education (3)
Examination of current developments and continuing controversies in the field of history of education. The analysis of the various ways in which history of education is approached methodologically and interpretatively.

EDPA 812 Seminar in Philosophy of Education (3)
Examination of current developments and continuing controversies in the field of philosophy of education. The function of educational philosophy, methodological approaches, and current research trends.

EDPA 813 Seminar in Educational Sociology (3)
Sociological analysis of educational processes and institutions; emphasis on the social effects of formal organizations.

EDPA 837 Curriculum Theory and Research (3)
Prerequisite: EDPA 635. Critical and analytic review of major themes, concepts and language forms relevant to current curriculum theory and research.

EDPA 839 Seminar in Teacher Education (3-6)
Repeatable to 6 credits. A problem seminar in teacher education.

EDPA 850 Seminar in Problems of Higher Education (3)
Contemporary issues and problems in post-secondary education relevant to the interests of both administrators and college/university faculty members.

EDPA 851 College and University Development (3)
Identification and acquisition of extramural fiscal resources for institutions of higher education. The nature of philanthropy, foundation solicitation, alumni administration, publications and public relations, and funding agency relationships.

EDPA 855 Lifelong Learning Policy (3)
Policies and programs for training and continued learning in business and industry, government agencies, unions, professional societies, and nonprofit organizations.

EDPA 861 Seminar: Research in School Effectiveness (3)
Prerequisite: permission of department. Examination of organizational effectiveness and the methodologies for assessing organizational effectiveness. An individual research project is required.

EDPA 862 Seminar: Theoretical Basis of Administrative Behavior (3)
Prerequisite: permission of department. Study of administrative behavior in educational institutions. Development of a research design for the study of administrative behavior in one educational institution.

EDPA 888 Apprenticeship in Education (1-8)
Prerequisite: permission of department. Apprentice practice under professional supervision in an area of competence compatible with the student's professional goals. Credit not to be granted for experience accrued prior to registration. Open only to degree- and certificate-seeking graduate students.

EDPA 889 Internship in Education (3-8)
Prerequisite: permission of department. Internship experiences at a professional level of competence in a particular role with appropriate supervision. Credit not to be granted for experience accrued prior to registration. Open only to students advanced to candidacy for doctoral degree.

EDPA 895 Research Critique Seminar (3)
Critiques of research designs in preparation for the doctoral dissertation.

EDPA 899 Doctoral Dissertation Research (1-8)
Registration required to the extent of 6-9 hours for an Ed.D. Project and 12-18 hours for a Ph.D. Dissertation.

EDSP – Education, Special

EDSP 400 Assessment, Curriculum and Instructional Methods For Students with Severe Handicaps (3)
Corequisites: [EDSP 402; and EDSP 431] or permission of department. Examination of functional assessment procedures, curriculum development and analysis, and instructional techniques for students with severe handicaps.

EDSP 401 Environmental Adaptations for Severely Handicapped Students (3)
Pre- or corequisites: [EDSP 411; and EDSP 412] or [EDSP 430; and EDSP 431]. Management problems of and alternatives for severely handicapped individuals.

EDSP 402 Field Placement: Severely Handicapped I (2-5)
Pre- or corequisites: [EDSP 400; and EDSP 404] or permission of department. Practicum experience in settings serving severely handicapped individuals. Enrollment limited to those admitted to severely handicapped specialty area. Field placement for two to five half-days per week.

EDSP 403 Physical and Communication Adaptations for Students with Severe Handicaps (3)
Prerequisites: [EDSP 400; and EDSP 404] or permission of department. Corequisites: [EDSP 330; and EDSP 405; and EDSP 410] or permission of department. Development, assessment, and instruction of mobility, feeding, grooming, and communication techniques to increase independent functioning for students with severe handicaps.

EDSP 404 Education of Students with Autism (3)
Pre- or corequisites: [EDSP 400 and EDSP 402] or permission of department. Characteristics, needs, assessment, and educational methods for students diagnosed as autistic.

EDSP 405 Field Placement: Severely Handicapped II (2-5)
Prerequisite: EDSP 402 or permission of department. Pre- or corequisites: EDSP 330; and EDSP 403; and EDSP 410 or permission of department. Practicum experience in settings serving severely handicapped individuals. Field placement for two to five half-days per week.

EDSP 410 Community Functioning Skills for Students with Severe Handicaps (3)
Prerequisites: [EDSP 400; and EDSP 404] or permission of department. Corequisites: EDSP 330; and EDSP 403; and EDSP 405. Assessment, instructional techniques, and curriculum development related to community functioning skills for students with severe handicaps.

EDSP 411 Field Placement: Severely Handicapped III (2-5)
Prerequisite: EDSP 405. Pre- or corequisites: [EDSP 412; and (EDSP 420 or EDSP 460)] or permission of department. Practicum experience in settings serving severely handicapped individuals. Field placement for two to five half-days per week.

EDSP 412 Vocational and Transitional Instruction For Students with Severe Handicaps (3)
Corequisites: [EDSP 411; and EDSP 465] or permission of department. Assessment and instructional strategies for developing the vocational and transitional skills of students with severe handicaps.

EDSP 417 Student Teaching: Severely Handicapped (4-11)
Student teaching, full-time for twelve weeks, with severely handicapped individuals. Limited to special education majors admitted to severely handicapped specialty area.

EDSP 418 Seminar: Issues and Research Related to the Instruction of Severely Handicapped Students (1-3)
For EDSP majors only. Repeatable to 6 credits if content differs. Examines the current research related to the instruction of severely handicapped individuals.

EDSP 420 Developmental and Behavioral Characteristics of Nonhandicapped and Handicapped Infants and Young Children (3)
Corequisites: [EDSP 421; and EDSP 411] or permission of department. Study of the developmental, behavioral, and learning characteristics of nonhandicapped and handicapped infants and young preschool children.

EDSP 421 Field Placement: Early Childhood Special Education I (2-3)
Pre- or corequisite: [EDSP 410 and EDSP 420] or permission of department. Practicum experience in settings serving preschool handicapped children. Opportunities for studying the patterns of development and learning among nonhandicapped and handicapped infants and older preschoolers. Enrollment limited to students admitted to early childhood specialty. Field placement for two or three half-days per week.

EDSP 422 Curriculum and Instruction in Early Childhood Special Education (Moderate to Mild: 3-8 Years) (3)
Prerequisites: EDSP 410; and EDSP 420 or permission of department. Corequisites: EDSP 330; and EDSP 424. Characteristics, methods and materials for the instruction of young children (ages 3-8) traditionally labeled mild to moderately handicapped.

EDSP 423 Assessment of Preschool Handicapped Children and Infants (3)
Prerequisites: EDSP 330; and EDSP 422. Corequisites: EDSP 430; and EDSP 431; and; EDSP 400 or EDSP 441. Current psychoeducational assessment and evaluation procedures used with profoundly to moderately handicapped infants and young preschool children. Psychometric, criterion-referenced, developmental checklists, and automated and ecological assessment procedures. Administration of selected assessment instruments.

EDSP 424 Field Placement: Early Childhood Special Education II (Moderate to Mild) (2-4)
Prerequisite: EDSP 421 or permission of department. Pre- or corequisites: EDSP 350; and EDSP 422. Practicum experience in settings serving young (ages 3 to 8) mild to moderately handicapped children in self-contained and integrated early childhood programs. Opportunities to apply educational methods and materials. Field placement for two to four half-days per week.

EDSP 430 Intervention Techniques and Strategies For Preschool Handicapped Children and Infants(Severe to Moderate, Birth-6 Years)(3)
Prerequisites: EDSP 330; and EDSP 422. Corequisites: EDSP 423; and EDSP 431; and (EDSP 440 or EDSP 441). Current approaches to the treatment of preschool severely to moderately handicapped children.

EDSP 431 Field Placement: Early Childhood Special Education III (Severe to Moderate) (2-4)
Prerequisite: EDSP 424 or permission of department. Pre- or corequisites: EDSP 430; and EDSP 423; and (EDSP 400 or EDSP 441). Opportunities to apply techniques, strategies, methods and materials for educating severely to moderately handicapped infants and young children. Field placement for two to four half-days per week.

EDSP 437 Student Teaching: Early Childhood Special Education (4-11)
Student teaching, full-time for twelve weeks, with handicapped infants and preschool children. Limited to special education majors in early childhood special education specialty area.

EDSP 438 Seminar: Special Issues in Early Childhood Special Education (1-3)
Prerequisite: permission of department. For EDSP majors only. Repeatable to 6 credits if content differs. Study of current issues and research concerning education of preschool handicapped children.

EDSP 440 Assessment and Instructional Design for the Educationally Handicapped: Cognitive and Psychosocial Development (3)
Prerequisites: [EDSP 441; and EDCI 456] or permission of department. Pre- or corequisites: EDSP 330; and EDSP 445; and EDHD 413. Learning style, cognitive, and problem-solving strategies, and psychosocial behavior of educationally handicapped individuals at elementary to secondary levels. Characteristics, assessment and instruction. Enrollment limited to Special Education majors accepted into educationally handicapped area of specialization.

EDSP 441 Assessment and Instructional Design for the Educationally Handicapped: Oral Language and Communication Disorders (3)
Corequisites: [EDSP 442; and EDSP 431] or permission of department. Characteristics of individuals with oral language and communication disorders, assessment of such disorders and instructional strategies, curricula and materials.

EDSP 442 Field Placement: Educationally Handicapped I (2-3)
Pre- or corequisite: [EDSP 441 and EDCI 456] or permission of department. Practicum experience in settings serving educationally handicapped individuals. Demonstration of the content of EDSP 441. Enrollment limited to students admitted to educationally handicapped specialty. Field placement for two or three half-days per week.

EDSP 443 Assessment and Instructional Design for the Handicapped: Reading and Written Communication Disorders (3)
Prerequisites: [EDSP 320; and EDSP 321] or permission of department. Pre- or corequisites: EDSP 331; and EDSP 332; and EDSP 333. Characteristics and assessments of individuals with reading and written communication disorders at elementary to secondary levels, and methods of teaching reading and written language skills to such individuals. Adaptation of regular instructional methods and curricula.

EDSP 445 Field Placement: Educationally Handicapped II (2-4)
Prerequisite: EDSP 442 or permission of department. Pre- or corequisites: EDSP 330; and EDSP 440; and EDSP 443; and EDHD 413. Practicum experience in settings serving educationally handicapped. The application of instructional design and assessment in cognitive development. Field placement for 2-4 half-days per week.

EDSP 446 Instructional Design for the Educationally Handicapped: Functional Living Skills (3)
Pre- or corequisites: [EDSP 447; and EDSP 465] or permission of department. Instructional methods, curricula and materials designed to teach functional living skills to educationally hand-

icapped individuals at elementary to secondary levels. Curricula and teaching strategies in science and social studies used in general education and adaptations for educationally handicapped individuals.

EDSP 447 Field Placement: Educationally Handicapped III (2-4)
Prerequisite: EDSP 445 or permission of department. Pre- or corequisites: EDSP 446; and EDSP 450; and EDSP 460. Practicum experience in settings serving educationally handicapped individuals. The application of the content of EDSP 446, EDSP 450 and EDSP 460. Field placement for two to four half-days per week.

EDSP 450 Program Management for the Educationally Handicapped (3)
Corequisites: [EDSP 411; and EDSP 447; and EDSP 465] or permission of department. Emphasis on skills in managing programs for educationally handicapped individuals. Service delivery models; scheduling; establishing referral, assessment and follow through procedures; methods for mainstreaming; training aides and volunteers.

EDSP 457 Student Teaching: Educationally Handicapped (4-11)
For EDSP majors only. Student teaching, full-time for twelve weeks, with educationally handicapped individuals.

EDSP 458 Seminar: Special Issues and Research Related to the Educationally Handicapped (1-3)
Repeatable to 6 credits if content differs. Current issues and research concerning the education of educationally handicapped individuals.

EDSP 460 Career/Vocational Education For the Handicapped (3)
Corequisites: [EDSP 461; and EDSP 411; and EDSP 447] or permission of department. Introduction to career/vocational education for the handicapped. Historical and current issues and trends, characteristics and training needs of handicapped individuals and review of existing programs.

EDSP 461 Field Placement: Career/Vocational I (2-3)
Pre- or corequisite: [EDSP 460; and EDSP 456; and EDIT 421] or permission of department. For EDSP majors only. Practicum experience in career vocational education for the handicapped. Field placement for two or three half-days per week.

EDSP 462 Vocational Assessment and Instruction in Special Education (3)
Prerequisite: EDSP 460 or permission of department. Current vocational assessment strategies, interpretation of assessment results, and planning, delivery and evaluation of instruction in vocational education for secondary students with disabilities.

EDSP 463 Field Placement: Career/Vocational II (2-3)
Prerequisite: EDSP 461 or permission of department. Pre- or corequisites: EDSP 330; and EDSP 462. Practicum experience in career/vocational programs for the handicapped. Field placement for two or three half-days per week.

EDSP 464 Secondary and Transition Methods in Special Education (3)
Prerequisite: EDSP 462 or permission of department. Current secondary vocational/special education issues and transition methods including work-study programming, job development, and job coaching.

EDSP 465 Field Placement: Career/Vocational III (2-3)
Prerequisite: EDSP 463; pre- or corequisite: EDSP 450. Practicum experience in career/vocational programs for the handicapped. Field placement for two or three half days per week.

EDSP 467 Student Teaching: Career/Vocational (4-11)
A full-time twelve week field assignment in a setting providing career/vocational education for handicapped students. Enrollment limited to Special Education majors who have successfully completed coursework in career/vocational area of specialization.

EDSP 468 Special Topics Seminar in Career/Vocational Education For the Handicapped (1-3)
Prerequisite: permission of department. For EDSP majors only. Repeatable to 6 credits if content differs. Current issues and research relating to career/vocational education of the handicapped.

EDSP 470 Introduction to Special Education (3)
Designed to give an understanding of the needs of all types of exceptional children.

EDSP 471 Characteristics of Exceptional Children: Mentally Retarded (3)
Prerequisite: EDSP 470 or equivalent. Studies the diagnosis etiology, physical, social and emotional characteristics of exceptional children.

EDSP 472 Education of Exceptional Children: Mentally Retarded (3)
Prerequisite: EDSP 471 or equivalent. Offers practical and specific methods of teaching exceptional children. Selected observation of actual teaching may be arranged.

EDSP 473 Curriculum For Exceptional Children: Mentally Retarded (3)
Prerequisite: EDSP 471 or equivalent. Examines the principles and objectives guiding curriculum for exceptional children; gives experience in developing curriculum; studies various curricula currently in use.

EDSP 475 Education of the Slow Learner (3)
Studies the characteristics of the slow learner and those educational practices which are appropriate for the child who is functioning as a slow learner.

EDSP 476 Communicating with Sign Language (3)
Prerequisite: EDSP 376 or permission of department. Intermediate level receptive/expressive skills in American Sign Language. Aspects of the culture, history, and research perspectives of the deaf community.

EDSP 480 Microcomputers in Special Education (3)
Microcomputers for the education of handicapped individuals.

EDSP 481 Characteristics of Exceptional Children: Gifted and Talented (3)
Prerequisite: EDSP 470 or equivalent. Studies the diagnosis, etiology, physical, social, and emotional characteristics of gifted and talented children.

EDSP 482 Education of Exceptional Children: Gifted and Talented (3)
Prerequisite: EDSP 481 or equivalent. Offers practical and specific methods of teaching gifted and talented children. Selected observation of actual teaching may be arranged.

EDSP 483 Curriculum For Exceptional Children: Gifted and Talented (3)
Prerequisite: EDSP 481 or equivalent. Examines the principles and objectives guiding current curriculum for gifted and talented children; gives experience in developing curriculum; studies various curricula currently in use.

EDSP 488 Selected Topics in Teacher Education (1-3)
Prerequisite: major in education or permission of department. Repeatable to 6 credits if content differs.

EDSP 489 Field Experiences in Special Education (1-4)
Prerequisite: permission of department. Planned field experience in education-related activities. Credit not to be granted for experiences accrued prior to registration.

EDSP 491 Characteristics of Learning Disabled Students: Perceptual Learning Problems (3)
Diagnosis, etiology, physical, social, and emotional characteristics of learning disabled students.

EDSP 492 Education of Learning Disabled Students (3)
Prerequisite: EDSP 491 or permission of department. Methods of teaching learning disabled children.

EDSP 493 Curriculum For Exceptional Children: Perceptual Learning Problems (3)
Prerequisite: EDSP 492 or equivalent. Examines the principles and objectives guiding curriculum for children with perceptual learning disabilities; gives experience in developing curriculum; studies various curricula currently in use.

EDSP 498 Special Problems in Special Education (1-6)
Prerequisite: permission of department. Available only to education majors who have definite plans for individual study of approved problems. Credit according to extent of work.

EDSP 499 Workshops, Clinics, and Institutes in Special Education (1-6)
Repeatable to 6 credits if content differs. The following type of educational enterprise may be scheduled under this course heading: workshops conducted by the special education department (or developed cooperatively with other departments, colleges and universities) and not otherwise covered in the present course listing. Laboratories, and special education centers; institutes developed around specific topics or problems and intended for designated groups such as school superintendents, principals and supervisors.

EDSP 600 Exceptional Children and Youth (3)
Prerequisite: 9 hours in special education and permission of department. Examines research relevant to the education of exceptional children and youth.

EDSP 601 Characteristics of Behaviorally Disordered Students (3)
Prerequisite: EDSP 600 or permission of department. Characteristics and theoretical perspectives related to students with behavioral disorders.

EDSP 605 The Exceptional Child and Society (3)
Prerequisite: EDSP 600 or permission of department. Relationship of the role and adjustment of the child with an exceptionality to societal characteristics.

EDSP 610 Administration and Supervision of Special Education Programs (3)
Prerequisite: EDSP 600 and permission of department. Consideration of the determination, establishment and function of educational programs to exceptional children for administrative and supervisory personnel.

EDSP 615 Evaluation and Measurement of Exceptional Children and Youth (3)
Prerequisites: [EDMS 446; and EDMS 646; and EDSP 600] or permission of department. Deals with the understanding and interpretation of the results of psychological and educational tests applicable for use with exceptional children and youth.

EDSP 620 Educational Diagnosis and Planning For Learning Disabled Students (3)
Prerequisites: [EDSP 491; and EDSP 615] or permission of department. Identification of learning characteristics of learning disabled students and planning of educational programs.

EDSP 621 Social and Academic Skill Development for Behaviorally Disordered Students (3)
Prerequisites: [EDSP 600; and EDSP 601] or permission of department. Prerequisite: EDSP 600, EDSP 601 or consent of instructor. Strategies to teach social and academic skills to behaviorally disordered students.

EDSP 625 Seminar on Severely Handicapping Conditions (3)
Prerequisite: EDSP 600 or permission of department. Research and theories relevant to the education of severely handicapped individuals.

EDSP 630 Problems in the Education of the Gifted (3)
Prerequisite: 9 hours in Special Education including EDSP 600 or permission of department. Consideration of the pertinent psychological, educational, medical, sociological and other research and theoretical material relevant to the determination of trends and practices regarding the gifted.

EDSP 635 Seminar: Behavioral Disorders (3)
Prerequisites: [EDSP 601; and EDSP 621] or permission of department. Methodological and theoretical issues related to behaviorally disordered students.

EDSP 640 Seminar: Learning Disabilities (3)
Prerequisites: [EDSP 492; and EDSP 600; and EDSP 615] or permission of department. Research and theoretical material relevant to trends and practices regarding the learning disabled.

EDSP 650 Seminar in Early Childhood Special Education (3)
Prerequisite: 9 hours in Special Education including EDSP 600 and EDSP 420, or permission of department. Pertinent psychological, educational, medical, and sociological material relevant to trends and practices regarding handicapped infants and preschool children.

EDSP 651 Program Planning and Instruction for Handicapped Infants and Children (3)
Pre- or corequisite: EDSP 430 or equivalent. Program design for serving high risk and handicapped infants from birth to three years of age.

EDSP 655 Seminar in Secondary and Transition Special Education (3)
Prerequisite: EDSP 600 or permission of department. Review of research pertaining to individuals with disabilities in secondary and post-secondary vocational and transitional settings.

EDSP 665 Working with Families of Handicapped Children and Youth (3)
Prerequisite: EDSP 600 or permission of department. Review of current practices and research pertaining to families of handicapped children and youth.

EDSP 666 Educating Handicapped Children and Youth with Communication Disabilitie (3)
Prerequisite: EDSP 600 or permission of department. Current practices and research pertaining to communication development, assessment, and intervention for children and youth with disabilities.

EDSP 675 Policy Issues Impacting Persons with Disabilities (3)
Prerequisite: permission of department. Public policy issues regarding persons with disabilities including deinstitutionalization, special education and employment, as well as research and evaluation.

EDSP 678 Seminar in Special Education (3)

EDSP 680 Advanced Use of Computers in Special Education (3)
Prerequisites: EDSP 480 or permission of department. Advanced course on computer applications with handicapped individuals emphasizing research, theoretical and practical issues.

EDSP 685 Policy Formulation and Persons with Disabilities (3)
Prerequisite: permission of department. Research into the process by which policies regarding persons with disabilities are formulated, implemented and evaluated.

EDSP 788 Selected Topics in Special Education (1-3)
Repeatable to 6 credits if content differs. Current topics and issues in teacher education.

EDSP 798 Special Problems in Special Education (1-6)
Prerequisite: permission of department. Intended for Master's, AGS, or doctoral students in education who desire to pursue a research problem.

EDSP 799 Master's Thesis Research (1-6)
Registration required to the extent of six hours for Master's thesis.

EDSP 860 Doctoral Research Seminar (3)
Issues and procedures relevant to conducting and analyzing research in special education.

EDSP 888 Apprenticeship in Special Education (1-8)
Prerequisite: permission of department. Apprentice practice under professional supervision in an area of competence compatible with the student's professional goals. Credit not to be granted for experience accrued prior to registration. Open only to degree- and certificate-seeking graduate students.

EDSP 889 Internship in Special Education (3-8)
Prerequisite: permission of department. Internship experiences at a professional level of competence in a particular role with appropriate supervision. Credit not to be granted for experience accrued prior to registration. Open only to students advanced to candidacy for doctoral degree.

EDSP 899 Doctoral Dissertation Research (1-8)
Registration required to the extent of 6-9 hours for an Ed.D. Project and 12-18 hours for a Ph.D. dissertation.

ENAE – Engineering, Aerospace

ENAE 401 Aerospace Laboratory II (2)
Prerequisites: ENAE 305; and ENAE 345. Corequisites: ENAE 452; and ENAE 471. Application of fundamental measurement techniques to experiments in aerospace engineering, structural, aerodynamic, and propulsion tests, correlation of theory with experimental results.

ENAE 402 Aerospace Laboratory III (1)
Prerequisites: ENAE 305; and ENAE 345. Corequisites: ENAE 452; and ENAE 471; and ENAE 475. Application of fundamental measurement techniques to experiments in aerospace engineering, structural, aerodynamic, flight simulation, and heat transfer tests. Correlation of theory with experimental results.

ENAE 411 Aircraft Design (3)
Prerequisites: ENAE 345; and ENAE 451; and ENAE 371. Theory, background and methods of airplane design, subsonic and supersonic.

ENAE 412 Design of Aerospace Vehicles (3)
Prerequisites: ENAE 345; and ENAE 371. Theory, background and methods of space vehicle design for manned orbiting vehicles, manned lunar and planetary landing systems.

ENAE 415 Computer-Aided Structural Design Analysis (3)
Prerequisite: ENAE 452 or permission of both department and instructor. Introduction to structural design concepts and analysis techniques. Introduction to computer software for structural analysis which is utilized to verify exact solutions and perform parametric design studies of aerospace structures.

ENAE 445 Stability and Control of Aerospace Vehicles (3)
Prerequisites: ENAE 345; and ENAE 371. Dynamics of flight vehicles with emphasis on stability and control of vehicles in the atmosphere.

ENAE 451 Flight Structures I: Introduction to Solid Mechanics (4)
Prerequisite: ENES 220. An introduction to the analysis of aircraft structural members. Introduction to theory of elasticity, mechanical behavior of materials, thermal effects, finite-difference approximations, virtual work, variational and energy principles for static systems.

ENAE 452 Flight Structures II: Structural Elements (3)
Prerequisite: ENAE 451. Application of variational and energy principles to analysis of elastic bodies; stresses and deflections of beams including effects of non-principal axes, non-homogeneity, and thermal gradients; differential equations of beams, bars, and cables. Stresses and deflections of torsional members, stresses due to shear. Deflection analysis of structures.

ENAE 453 Matrix Methods in Computational Mechanics (3)
Prerequisite: ENAE 452 or permission of both department and instructor. Introduction to the concepts of computational analysis of continuous media by use of matrix methods. Foundation for use of finite elements in any field of continuum mechanics, with emphasis on the use of the displacement method to solve thermal and structural problems.

ENAE 461 Flight Propulsion I (3)
Prerequisites: ENAE 217; and ENAE 471. Operating principles of piston, turbojet, turboprop, ramjet and rocket engines, thermodynamic cycle analysis and engine performance, aerothermochemistry of combustion, fuels, and propellants.

ENAE 462 Flight Propulsion II (3)
Prerequisite: ENAE 461. Advanced and current topics in flight propulsion.

ENAE 471 Aerodynamics II (3)
Prerequisites: ENAE 371; and ENME 217. Elements of compressible flow with applications to aerospace engineering problems.

ENAE 472 Aerodynamics III (3)
Prerequisite: ENAE 371. Theory of the flow of an incompressible fluid.

ENAE 473 Aerodynamics of High-Speed Flight (3)
Prerequisite: ENAE 471 or equivalent. An advanced course dealing with aerodynamic problems of flight at supersonic and hypersonic velocities. Unified hypersonic and supersonic small disturbance theories, real gas effects, aerodynamic heating and mass transfer with applications to hypersonic flight and re-entry.

ENAE 475 Viscous Flow and Aerodynamic Heating (3)
Prerequisites: ENAE 371; and ENAE 471; and ENME 217. Fundamental aspects of viscous flow, Navier-Stokes equations, similarity, boundary layer equations; laminar, transitional and turbulent incompressible flows on airfoils, thermal boundary layers and convective heat transfer; conduction through solids, introduction to radiative heat transfer.

ENAE 488 Topics in Aerospace Engineering (1-4)
Technical elective taken with the permission of the student's advisor and instructor. Lecture and conference courses designed to extend the student's understanding of aerospace engineering. Current topics are emphasized.

ENAE 499 Elective Research (1-3)
Prerequisites: senior standing in ENAE major and permission of department, instructor, and student's advisor. Repeatable to 6 credits. Original research projects terminating in a written report.

ENAE 631 Helicopter Aerodynamics I (3)
Prerequisite: permission of both department and instructor. Introduction to hovering theory. Hovering and vertical-flight performance analyses. Factors affecting hovering and vertical-flight performance. Autorotation and vertical descent. Physical concepts of blade motion and rotor control. Aerodynamics of forward flight and performance calculations. Prediction and effects of rotor blade stall.

ENAE 632 Helicopter Aerodynamics II (3)
Prerequisites: [ENAE 631; and ENAE 371 or equivalent] or permission of both department and instructor. Basic inviscid incompressible aerodynamic theory with application to the calculation of the flowfield and loads for rotary wings.

ENAE 633 Helicopter Dynamics (3)
Prerequisite: ENAE 631 or permission of both department and instructor. Flap dynamics. Mathematical methods to solve rotor dynamics problems. Flap-lag-torsion dynamics and identify structural and inertial coupling terms. Overview on rotary wing unsteady aerodynamics. Basic theory of blade aero-elastic stability and ground resonance problems.

ENAE 634 Helicopter Design (3)
Prerequisite: ENAE 631 or permission of both department and instructor. Principles and practice of the preliminary design of helicopters and similar rotary wing aircrafts. Design trend studies, configuration selection and sizing methods, performance and handling qualities analyses, struc-

tural concepts, vibration reduction and noise. Required independent design project conforming to a standard helicopter request for proposal (RFP).

ENAE 635 Helicopter Stability and Control (3)
Prerequisite: ENAE 631 or permission of both department and instructor. Advanced dynamics as required to model rotorcraft for flight dynamic studies. Development of appropriate models for the helicopter and study of stability, control, requirements for various applications, and handling qualities as determined by mission requirements.

ENAE 640 Flight Mechanics I (3)
Prerequisite: ENAE 445 or permission of both department and instructor. Studies in the dynamics and control of flight vehicles. Fundamentals of the dynamics of rigid and non-rigid bodies and their motion under the influence of aerodynamic and gravitational forces.

ENAE 641 Flight Mechanics II (3)
Prerequisite: ENAE 640 or permission of both department and instructor. A continuation of ENAE 640.

ENAE 650 Variational Methods in Structural Mechanics (3)
Prerequisite: ENAE 452 or equivalent. Review of theory of linear elasticity with introduction to cartesian tensors; application of calculus of variations and variational principles of elasticity; Castigliano's theorems; applications to aerospace structures.

ENAE 652 Finite Element Method in Engineering (3)
Prerequisite: ENAE 650 or permission of both department and instructor. Development of finite element representation of continua using Galerkin and variational techniques. Derivation of shell elements and parametric representation of two and three dimensional elements. Application to aerospace structures, fluids and diffusion processes.

ENAE 653 Nonlinear Finite Element Analysis of Continua (3)
Prerequisite: ENAE 652. Finite element formulation of nonlinear and time dependent processes. Introduction to tensors, nonlinear elasticity, plasticity and creep. Application to nonlinear continua including aerospace structures, shells, radiation heat transfer, creep.

ENAE 654 Composite Structures (3)
Prerequisite: ENAE 452 or permission of both department and instructor. Stiffness of unidirectional composites, stress and strain transformation, inplane and bending stiffness of symmetric laminates, properties of general laminates, strength of composite structures, environmental effect.

ENAE 655 Structural Dynamics I (3)
Prerequisite: ENAE 452 or equivalent or permission of both department and instructor. Advanced principles of dynamics necessary for structural analysis; solutions of eigenvalue problems for discrete and continuous elastic systems, solutions to forced response boundary value problems by direct, modal, and transform methods.

ENAE 656 Structural Dynamics II (3)
Prerequisite: ENAE 655 or permission of both department and instructor. Topics in aeroelasticity: wing divergence; aileron reversal; flexibility effects on aircraft stability derivatives; wing, empennage and aircraft flutter; aircraft gust response.

ENAE 657 Theory of Structural Stability (3)
Prerequisite: ENAE 452 or equivalent. Static and dynamic stability of structural systems. Classification of leading systems: linear and nonlinear post--buckling behavior. Perfect and imperfect system behavior. Buckling and failure of columns and plates.

ENAE 661 Advanced Propulsion I (3)
Prerequisites: ENAE 461; and ENAE 462. Special problems of thermodynamics and dynamics of aircraft power plants; jet, rocket and ramjet engines. Plasma, ion and nuclear propulsion for space vehicles.

ENAE 662 Advanced Propulsion II (3)
Prerequisite: ENAE 661. Special problems of thermodynamics and dynamics of aircraft power plants; jet, rocket and ramjet engines. Plasma, ion and nuclear propulsion for space vehicles.

ENAE 671 Aerodynamics of Incompressible Fluids (3)
Prerequisite: MATH 463 or permission of instructor. Fundamental equations in fluid mechanics. Irrotational motion. Circulation theory of lift. Thin airfoil theory. Lifting line theory. Wind tunnel corrections. Perturbation methods.

ENAE 672 Aerodynamics of Incompressible Fluids (3)
Prerequisite: MATH 463 or permission of instructor. Fundamental equations in fluid mechanics. Irrotational motion. Circulation theory of lift. Thin airfoil theory. Lifting line theory. Wind tunnel corrections. Perturbation methods.

ENAE 673 Aerodynamics of Compressible Fluids I (3)
Prerequisite: ENAE 471; or permission of both department and instructor. One-dimensional flow of a perfect compressible fluid. Shock waves. Two-dimensional linearized theory of compressible flow. Two-dimensional transonic and hypersonic flows. Exact solutions of two-dimensional isotropic flow. Linearized theory of three-dimensional potential flow. Exact solution of axially symmetrical potential flow. One-dimensional flow with friction and heat addition.

ENAE 674 Aerodynamics of Compressible Fluids II (3)
Prerequisite: ENAE 673. One-dimensional flow of a perfect compressible fluid. Shock waves. Two-dimensional linearized theory of compressible flow. Two-dimensional transonic and hypersonic flows. Exact solutions of two-dimensional isotropic flow. Linearized theory of three-dimensional potential flow. Exact solution of axially symetrical potential flow. One-dimensional flow with friction and heat addition.

ENAE 675 Aerodynamics of Viscous Fluids I (3)
Prerequisite: ENAE 475 or permission of department. Derivation of navier stokes equations, some exact solutions: boundary layer equations. Laminar flow-similar solutions, compressibility, transformations, analytic approximations, numerical methods, stability and transition of turbulent flow. Turbulent flow-isotropic turbulence, boundary layer flows, free mixing flows.

ENAE 676 Aerodynamics of Viscous Fluids II (3)
Prerequisite: ENAE 675. Derivation of navier stokes equations, some exact solutions: boundary layer equations. Laminar flow-similar solutions, compressibility, transformations, analytic approximations, numerical methods, stability and transition to turbulent flow. Turbulent flow-istropic turbulence, boundary layer flows, free mixing flows.

ENAE 688 Seminar (1-3)

ENAE 757 Advanced Structural Dynamics (3)
Prerequisite: ENAE 655 or equivalent. Fundamentals of probability theory pertinent to random vibrations, including correlation functions, and spectral densities; example random processes; response of single degree and multidegree of freedom systems.

ENAE 788 Selected Topics in Aerospace Engineering (1-3)

ENAE 799 Master's Thesis Research (1-6)

ENAE 899 Doctoral Dissertation Research (1-8)

ENAG – Engineering Agricultural

ENAG 414 Mechanics of Food Processing (4)
Prerequisite: PHYS 121. Three lectures and one laboratory per week. Applications in the processing and preservation of foods, of power transmission, hydraulics, electricity, thermodynamics, refrigeration, instruments and controls, materials handling and time and motion analysis.

ENAG 421 Power Systems (3)
Two hours of lecture and two hours of laboratory per week. *Prerequisite: ENME 217 and ENEE 300 and [ENME 342 or ENCE 330].* Analysis of energy conversion devices including internal combustion engines, electrical and hydraulic motors. Fundamentals of power transmission and coordination of power sources with methods of power transmission.

ENAG 422 Soil and Water Engineering (3)
Prerequisite: ENME 342 or ENCE 330. Applications of engineering and soil sciences in erosion control, drainage, irrigation and watershed management. Principles of agricultural hydrology and design of water control and conveyance systems.

ENAG 424 Functional and Environmental Design of Agricultural Structures (3)
Two hours of lecture and two hours of laboratory per week. *Prerequisite: ENAG 454.* An analytical approach to the design and planning of functional and environmental requirements of plants and animals in semior completely enclosed structures.

ENAG 435 Aquacultural Engineering (3)
Prerequisite: permission of department. A study of the engineering aspects of development, utilization and conservation of aquatic systems. Emphasis will be on harvesting and processing aquatic animals or plants as related to other facets of water resources management.

ENAG 444 Functional Design of Machinery and Equipment (3)
Two hours of lecture and two hours of laboratory per week. *Prerequisite: ENES 221. Senior standing.* Theory and methods of agricultural machine design. Application of machine design principles and physical properties of soils and agricultural products in designing machines to perform specific tasks.

ENAG 454 Biological Process Engineering (4)
Prerequisite: ENME 342 or ENCE 330. Design of systems to pump, heat, cool, dry and control biological materials as part of food and agricultural engineering. The effect of physical parameters on biological material response to these processes.

ENAG 488 Topics in Agricultural Engineering Technology (1-3)
Prerequisite: permission of department. Selected topics in agricultural engineering technology of current need and interest. May be repeated to a maximum of six credits if topics are different. Not acceptable for credit towards major in agricultural engineering.

ENAG 489 Special Problems in Agricultural Engineering (1-3)
Prerequisite: permission of department. Student will select an engineering problem and prepare a technical report. The problem may include design, experimentation, and/or data analysis.

ENAG 499 Special Problems in Agricultural Engineering Technology (1-3)
Prerequisite: permission of department. Not acceptable for majors in agricultural engineering. Problems assigned in proportion to credit.

ENAG 601 Instrumentation Systems (3)
Prerequisite: permission of department. Analysis of instrumentation requirements and techniques for research and operational agricultural or biological systems.

ENAG 602 Laboratory Applications of Microcomputers (3)
Laboratory instrumentation emphasizing microcomputers. Programming in BASIC, with all applications directed toward data acquisition and analysis. Program documentation, user-friendliness features, file handling, graphics, A/D conversion, digital filtering, and digital image processing.

ENAG 631 Land and Water Resource Development Engineering (3)
Prerequisite: ENAG 422 or permission of department. A comprehensive study of engineering aspects of orderly development for land and water resources. Emphasis on project formulation, data acquisition, project analysis and engineering economy.

ENAG 688 Advanced Topics in Agricultural Engineering (1-4)
Prerequisite: permission of department. Advanced topics of current interest in the various areas of agricultural engineering. Maximum eight credits.

ENAG 698 Seminar (1)
First and second semesters.

ENAG 699 Special Problems in Agricultural and Aquacultural Engineering (1-6)
First and second semester and summer school. Work assigned in proportion to amount of credit.

ENAG 701 Bioengineering Analysis of Human Physiological Response (3)
Modeling of human physiology yields insight, understanding and the ability to predict responses. This course will present physiological principles from a bioengineering viewpoint; survey basic models appearing in the literature and the mechanics and control of energetics, biomechanics, cardiovascular, thermal, and respiratory responses.

ENAG 799 Master's Thesis Research (1-6)

ENAG 899 Doctoral Dissertation Research (1-8)

ENCE – Engineering, Civil

ENCE 410 Advanced Strength of Materials (3)
Prerequisites: ENCE 350; and MATH 246. Behavior of structural members under load. Straight and curved beam analysis, unsymmetrical bending, shear center, beams on elastic foundation. Torsion of solid and thin walled members. Applied elasticity and stress-strain relations. Advanced topics in mechanics.

ENCE 411 Construction Scheduling and Estimating (4)
Two hours of lecture and one hour of laboratory per week. Use of critical path planning and scheduling with arrow and precedence networks; project time control; introduction to resource leveling and least cost scheduling. Cost estimating, using cost indices. Parametric estimates and unit price estimates.

ENCE 420 Construction Equipment and Methods (3)
Evaluation and selection of equipment and methods for engineering/constructi on projects, including earthmoving, paving, steel and concrete construction, rock excavation, tunneling, site preparation, and organization of the site.

ENCE 421 Construction Engineering and Management (3)
Overview of the construction industry and the factors that need to be considered to successfully manage engineering/ construction projects. Introduction into how resources of money, labor, material and equipment are committed and managed within the construction environment.

ENCE 423 Production Planning and Control (4)
Three hours of lecture and three hours of laboratory per week. *Prerequisite: ENCE 320.* Application of planning and scheduling techniques for construction work; introduction to resource leveling and cost control. Design of formwork, trench supports and cofferdams.

ENCE 424 Operations Analysis for Construction (3)
Application of logical analytical techniques and processes to problems of design and construction; an introduction to decision-making methods and application to construction situations; simulation modeling in construction environment.

ENCE 425 Decision Support Systems for Construction (3)
Two hours of lecture and three hours of laboratory per week. Information technology, database systems and concepts, and an introduction to artificial intelligence. The laboratory will offer oppurtunities to undertake computer applications and to devise systems for implementation.

ENCE 430 Flow in Open Channels and Conveyance Structures (4)
Three hours of lecture and three hours of laboratory per week. *Prerequisite: ENCE 330.* Application of theoretical, experimental and computer simulation techniques in the design of open

channels and conveyance structures including transitions, spillways, culverts, wiers, and bridge openings. Uniform and non-uniform flows under subcritical or supercritical conditions. Analysis of unsteady, spatially varied overland and channel flows. Laboratories will emphasize techniques to improve understanding of complex flow phenomena and to provide design information.

ENCE 431 Surface Water Hydrology (3)
Prerequisite: ENCE 330. Study of the physical processes of the hydrologic cycle. Hydrometeorology, concepts of weather modification, evaporation and transpiration infiltration studies, runoff computations, flood routing, reservoir requirements, emphasis on process simulation as a tool in the water resource development.

ENCE 432 Ground Water Hydrology (3)
Prerequisite: ENCE 330. Concepts related to the development of the ground water resource, hydrogeology, hydrodynamics of flow through porous media, hydraulics of wells, artificial recharge, sea water intrusion, basin-wide ground water development.

ENCE 433 Environmental Engineering Analysis (3)
Two hours of lecture and one hour of laboratory per week. *Prerequisites: CHEM 113; and ENCE 221.* The theory and analytical techniques used in evaluating man's environment. Emphasis on quantitative, physical, electroanalytical and organic chemistry as applied to chemical analysis of water.

ENCE 435 Sanitary Engineering Analysis and Design (4)
Three hours of lecture and one hour of laboratory per week. *Prerequisites: ENCE 221; and ENCE 330.* The application of sanitary analysis and fundamental principles to the design and operation of water and waste water treatment plants and the control of stream pollution.

ENCE 436 Drinking Water Treatment (3)
Prerequisite: ENCE 315. Formerly ENCE 434. Basic theory and practical design considerations for unit proceesses involved in drinking water treatment. The physiochemical operations considered include coagulation/flocculation, sedimentation, filtration, adsorption, ion exchange, aeration, and disinfection.

ENCE 440 Engineering Soil Tests (4)
Two hours of lecture and two hours of laboratory per week. *Prerequisite: ENCE 340.* Review of major soil tests and their interpretation for engineering purposes. Engineering classification tests (Atterberg limits, grain-size distribution, specific gravity), permeability and seepage properties, in-situ and lab density-moisture tests, soil strength (penetrometers, vane shear, CBR, unconfined compression, direct shear and triaxial) and compressibility characteristics.

ENCE 441 Soil-Foundation Systems (3)
Prerequisite: ENCE 340. Review of classical lateral earth pressure theories, analysis of braced excavation systems, cantilever and anchored sheet piling design, bearing capacity of shallow foundations (footings and mats) design of deep pile foundations to include pile capacity and pile group action.

ENCE 442 Highway and Airfield Pavement Design (3)
Prerequisite: ENCE 340 Principles relative to the design, construction and rehabilitation of highway and airfield pavement systems. Introduction to multi-layered elastic and slab theories, properties of pavement materials and methods of characterization, stochastic treatment of design variables, economic principles of design alternates and the effect of environment upon pavement performance. Review of existing rigid and flexible design methods as well as major fundamentals relative to the rehabilitation of existing pavement systems.

ENCE 453 Computer-Aided Structural Analysis (4)
Three hours of lecture and three hours of laboratory per week. *Prerequisites: ENCE 201; and ENCE 355.* Computer-aided analysis of structural systems. Unified matrix formulation of stiffness

and flexibility methods. Slope deflection method. Evaluation of truss, frame, and grid systems. Non-prismatic and curved elements. Error analysis and determination of ill-conditions. Introduction to finite element methods; formulation of simple two-dimensional elements. In laboratory, use and development of CAD software.

ENCE 454 Design of Concrete Structures (3)
Prerequisites: ENCE 255; and ENCE 355. Formerly ENCE 451. Combined bending and compression, development and anchorage of reinforcement, deflections, design of slabs including one-way and two-way, design of footings, retaining walls, introduction to prestressed concrete, design of multi-story buildings.

ENCE 455 Design of Steel Structures (3)
Prerequisites: ENCE 255; and ENCE 355. Formerly ENCE 450. Behavior and design of members subjected to fatigue, and combined bending and compression; plate girders, composite beams, open-web joists and connections. Methods of allowable stress design, and load and resistance factor design. Elements of plastic analysis and design. Framing systems and loads for industrial buildings and bridges.

ENCE 460 Modern Techniques For Structural Analysis (3)
Two hours of lecture and one hour of laboratory per week. *Prerequisite: ENCE 360. Pre- or corequisite: ENCE 351.* Application of computer oriented methods and numerical techniques to analysis and design of structural systems. Matrix formulation of the stiffness and flexibility methods for framed structures. Introduction of numerical techniques to the solution of selected problems in such topics as plates, structural stability, and vibrations.

ENCE 461 Analysis of Civil Engineering Systems I (3)
Prerequisite: permission of department. Application of the principles of engineering economy and statistics to the solution of civil engineering problems. Economic comparison of alternatives using present worth, annual cost, rate of return and cost benefit analyses. Development and use of simple and multiple regression models, and statistical decision theory.

ENCE 462 Systems Analysis for Civil Engineers (3)
Prerequisite: ENCE 201. Systems analysis concepts including classifications, life-cycle engineering and function. Deterministic modeling and optimization with emphasis on civil engineering applications. Queing theory analysis and simulation and systems engineering management.

ENCE 463 Economic Analysis for Civil Engineers (3)
Prerequisite: permission of department. Development and application of engineering economic principles to engineering problems. Evaluation of design alternatives in terms of costs and benifits, tax effects and uncertainties. Introduction to micro-economic analysis.

ENCE 464 Computer Applications in Civil Engineering (3)
Senior standing. For ENCE majors only. A broad range of computer applications in civil engineering are surveyed, with emphasis on applications and techniques suited to desk-top workstations, including workstation hardware and software components, operating systems and programming languages, structured programming concepts and the design of interactive engineering software, advanced input/output techniques, data structures, non-numeric algorithms, engineering computer graphics, general applications software, and data communications.

ENCE 465 Geographic Information Systems for Planning and Design Models (3)
Senior standing. For ENCE majors only. Application of computer-centered techniques to develop, manage, and interpret multi-dimensional data bases required for large scale projects in transportation, water resources, and environmental engineering. Translation of digital format data from remote sensing or conventional sources to quantitative information. Required for spatially distributed simulation models. Use of instructional geographic information systems and image processing software on personal computers.

ENCE 466 Design of Civil Engineering Systems (3)
One hour of lecture, four hours of laboratory, and one hour of discussion/recitation per week. *For graduating seniors only. For ENCE majors only.* A major civil engineering design experience that emphasizes development of student creativitY, development and use of design methodologies, evaluation of alternate solutions, feasibility considerations, and detailed system descriptions. Realistic design constraints including economic factors, safety, aesthetics, and reliability will be imposed. Students will work in design project groups and be required to exercise oral and written communication skills.

ENCE 470 Highway Engineering (4)
Three hours of lecture and three hours of laboratory per week. *Prerequisite: ENCE 370.* Location, design, construction and maintenance of roads and pavements. Introduction to traffic engineering.

ENCE 473 Air and Water Transportation Engineering (3)
Prerequisite: ENCE 370. Detailed study of the planning, design, construction, operations and maintenance of airports and waterways, emphasis on design and operations of transportation facilities.

ENCE 474 Railroad Mass Transportation Engineering (3)
Prerequisite: ENCE 370. Detailed study of the planning, design, construction, operations, and maintenance of railroads and mass transportation systems, emphasis on design and operations of transportation facilities.

ENCE 489 Special Problems in Civil Engineering (1-4)
Senior standing. For ENCE majors only. A course arranged to meet the needs of exceptionally well prepared students for study in a particular field of civil engineering.

ENCE 610 Advanced Strength of Materials (3)
Prerequisites: ENES 220; and ENES 221; and ENCE 300, or equivalent. Analysis for stress and deformation in engineering members by the methods of mechanics of materials and elementary theories of elasticity and plasticity. Problems in flexure, Torison plates and shells, stress concentrations, indeterminate combinations, residual stresses, stability.

ENCE 612 Structures Research Methods and Model Analysis (3)
Prerequisites: ENCE 450; and ENCE 451, or equivalent. Instrumentation, data analysis; states of stress; structural models, structural similitude; analogies; non-destructive testing techniques; planning research projects, lab studies and reports.

ENCE 620 Urban-regional Civil Engineering Planning (3)
Prerequisite: degree in civil engineering or permission of both department and instructor. Theory and methodology for the synthesis of general civil engineering aspects of urban and regional planning. Integration of land use conditions and capabilities, population factors and needs, engineering economics and engineering technologies. Application to special problems in urban-regional development. Preparation of engineering reports. Presentation methods. Fall semester.

ENCE 621 Civil Engineering Planning (3)
Prerequisite: ENCE 620 or equivalent. General to comprehensive planning of complex engineering facilities such as industrial plants, bridges, utilities and transportation projects. Planning based on the synthesis of all applicable factors. Emphasis on general civil engineering planning including site, structural and construction planning. Plan evaluation and feasibility. Spring semester.

ENCE 622 Urban and Regional Systems Analysis (3)
Pre- or corequisite: ENCE 461 or permission of both department and instructor. Current applications and research approaches in land-use forecasting, land-use evaluation, urban transportation, land-use interrelationships, and the planning implementation process in a systems analytic framework.

ENCE 623 Interpretation of Satellite Imagery For Regional Analysis (3)
Prerequisites: foundation courses in computer programming and statistics. The concepts and approaches used in the computer-aided interpretation of digital format data collected by orbiting electro-magnetic scanner systems. Emphasis on the translation of computer compatible tapes from the landsat series of satellites into information required for the analysis of land and water related problems on a regional scale.

ENCE 630 Environmental and Water Resource Systems I (3)
Prerequisite: permission of both department and instructor. Application of statistical and systems engineering techniques in the analysis of information necessary for the design or characterization of environmental or hydrologic processes; emphasis on the fundamental considerations that control the design of information collection programs, data interpretation, and the evolution of simulation models used to support the decision-making process.

ENCE 631 Physical Foundations For Hydrologic Modeling (3)
Prerequisite: ENCE 431 or permission of both department and instructor. A detailed analysis of the physical processes controlling the distribution of runoff from land areas. Infiltration, interception, transpiration, evaporation, and spatially varied flows. Emphasis on developing an understanding of the physics of hydrologic processes and translating this understanding into models that can be used.

ENCE 632 Free Surface Flow (3)
Prerequisite: ENCE 330 or equivalent. Application of fundamentals of fluid mechanics to problems of free surface flow; computation of steady and transient water surface profiles; stratified flows in reservoirs and estuaries; diffusion; transition structures; sediment transport.

ENCE 633 The Chemistry of Natural Waters (3)
Prerequisite: ENCE 433 or permission of both department and instructor. Application of principles from chemical thermodynamics and kinetics to the study and interpretation of the chemical characteristics of natural water systems. Explanation of the chemical composition of natural waters from a consideration of metal ion solubility controls, ph, carbonate equilibria, absorption reactions, redox reactions, and the kinetics of oxygenation reactions which occur in natural water environments.

ENCE 635 Design of Water Purification Facilities (3)
One hour of lecture and two hours of laboratory per week. *Corequisite: ENCE 636 or equivalent.* Application of basic science and engineering science to design of water supply and purification processes; design and economics of unit operations as applied to environmental systems.

ENCE 636 Unit Operations of Environmental Engineering (3)
Prerequisite: ENCE 221 or permission of both department and instructor. Properties and quality criteria of drinking water as related to health are interpreted by a chemical and biological approach. Legal aspects of water use and handling are considered. Theory and application of aeration, sedimentation, filtration, centrifugation, desalinization, corrosion and corrosion control are among topics to be considered.

ENCE 637 Biological Principles of Environmental Engineering (3)
Prerequisite: permission of both department and instructor. An examination of biological principles directly affecting man and his environment, with particular emphasis on microbiological interactions in environmental engineering related to air, water and land systems; microbiology and biochemistry of aerobic and anaerobic treatment processes for aqueous wastes.

ENCE 640 Advanced Soil Mechanics (3)
Prerequisite: ENCE 340 or equivalent. Introduction to the use of elastic theory in stress and displacement solutions to geotechnical engineering (soil and rock mechanics). The effect of soil moisture (at rest) relative to effective stress principles, capillary and frost. Exact and numeric

techniques for the analysis for soil seepage under isotropic and anisotropic conditions. Classical settlement (consolidation) and compressiblility theories, including finite difference solution for vertical and radial drainage.

ENCE 641 Advanced Foundations (3)

Prerequisite: ENCE 340 or equivalent. Introduction to braced lateral earth pressure concepts and theories applied to foundations. Analysis of braced excavations, retaining walls and design of cantilever and anchored sheet piling systems. Principles of Cofferdam design; bearing capacity theories related to shallow and deep foundations; soil-foundation interactions for footing and mat designs and analysis of single pile and pile group foundations. Exact and numeric solution techniques.

ENCE 642 Soil Dynamics (3)

Pre- or corequisite: ENCE 640 or permission of both department and instructor. Introduction to field and laboratory methods for determining the dynamic characterizationof soil at both small and large strain levels. Analysis and design of soil foundations subjected to machinery generated vibrations. A critical review of earthquake causes and their effect upon foundations and earth structures relative to earthquake resistant design methodologies.

ENCE 643 Stability of Earth Structures (3)

Prerequisite: ENCE 340 or equivalent. Shear strength of saturated and partially saturated cohesive and cohesionless soils incorporating the effects of stress history and in-situ stress conditions. Fundamentals of lateral earth pressure and classical methods of analysis. Integration of basic techniques of subsurface exploration methods (equipment, sampling tubes, and number of samples) with the above topics to critically analyze stability of earth structures (landslides, slope stability and earth dam stability).

ENCE 644 Engineering Soil Problems of North America (3)

Prerequisite: ENCE 340 or equivalent. A critical review of the distribution of the soils in North America with respect to engineering design and construction problems. Design factors such as availability of quality aggregate resources, soil origin and texture, high volume change soils, potentially poor subgrade support conditions, and frost-susceptible soils.

ENCE 645 Embankment Dam Design (3)

The design procedures involved in embankment dam design, touching on preliminary considerations, embankment design and construction preparation, with special attention to rock fill dams, small dams, and mine waste disposal dams. Dam surveillance, safety and repair.

ENCE 646 Rock Mechanics (3)

The composition, structure, and properties of intact rock and discontinuous rock masses and to the practical analysis and design techniques for common rock engineering problems.

ENCE 651 Matrix Methods of Structural Analysis (3)

Review of basic structural and matrix theory. Development of force and displacement methods with emphasis on the latter. Discussion of special topics such as geometric non-linearity, automated and optimum design non-prismatic members and thin-walled open sections and subdivision of large structures. Emphasis on applications to civil engineering structures.

ENCE 652 Analysis of Plate and Shell Structures (3)

Prerequisites: ENCE 410; and ENCE 381 or equivalent. Review of theory of elasticity and in-plane forces; theory of orthotropic plates; approximate methods; large deflection theory; buckling; general theory of shells, cylindrical shells, domes.

ENCE 653 Structural Dynamics (3)

Analysis of the dynamic response of structures and structural components subjected to impact load, transient load, and ground excitations; study of single degree-of-freedom and multi degree-of-freedom systems in classical closed form solution and approximate numerical solution; solution in the frequency domain and the use of finite element method.

ENCE 655 Plastic Analysis and Design of Structures (3)
Prerequisite: permission of both department and instructor. The study of the factors affecting the plastic behavior of steel structures and the criteria necessary for design. The design of beams, rigid frames and multi-story braced frames using current specifications. A review of current research and practice.

ENCE 656 Advanced Steel Design (3)
Prerequisites: ENCE 450; and ENCE 451 or equivalent. Interpretation of specifications and codes for the design of steel buildings and bridges. Discussion of the behavior of steel connections, members and structures; the relationship between behavior and design specifications.

ENCE 657 Theory of Structural Design (3)
Prerequisite: ENCE 656. Correlation of theory, experience, and experiments in study of structural behavior, proportioning, and preliminary design. Special design problems of fatigue, buckling, vibrations, and impact.

ENCE 660 Engineering Analysis (3)

ENCE 661 Finite Element Techniques in Engineering Analysis (3)
Prerequisite: permission of both department and instructor. Basic principles and fundamental concepts of the finite element method. Consideration of geometric and material nonlinearities, convergence, mesh gradation and computational procedures in analysis. Applications to plane stress and plane strain, plates and shells, eigenvalue problems, axi-symmetric stress analysis, and other problems in civil engineering.

ENCE 662 Construction Project Management (3)
The techniques needed by a project manager to be successful in the engineering/construction environment. Organizations and information needed by the construction manager to make timely decisions which affect quality, cost, progress and safety issues.

ENCE 663 Management of Construction Organizations (3)
Study of establishing authority and responsibility for construction management techniques for motivating construction labor organizations; and traits needed for success in managing construction projects.

ENCE 664 Project Acquisition and Risk Management (3)
Concepts and current issues surrounding construction project evaluation and financing. The use of decision theory in evaluating project feasibility studies.

ENCE 665 Project Planning and Resource Allocation (3)
Analytic techniques for planning and controlling the duration of construction project. Networking techniques, including treatment of uncertainty, resource allocation and leveling, and time/cost tradeoff.

ENCE 666 Cost Engineering and Control (3)
Analytic techniques to estimate and control project costs, including site investigation, quantity takeoff, work analysis and bid preparation. Systematic cost control as related to job production and historical data.

ENCE 667 Construction Operations and Improvement (3)
Applications of time-lapse photography, crew balance, process charts, delay surveys, and other techniques to permit improvement analysis of construction operations. The use of safety, incentive and communication programs for productivity improvement.

ENCE 670 Highway Traffic Characteristics and Measurements (3)
Prerequisite: ENCE 470 or permission of both department and instructor. The study of the fundamental traits and behavior patterns of road users and their vehicles in traffic. The basic characteristics of the pedestrian, the driver, the vehicle, traffic volume and speed, stream flow and intersection operation, parking, and accidents.

ENCE 671 Highway Traffic Operations (3)
Prerequisites: [ENCE 470; and ENCE 670] or permission of both department and instructor. A survey of traffic laws and ordinances. The design, application and operation of traffic control devices and aids, including traffic signs and signals, pavement markings, and hazard delineation. Capacity, accident, and parking analyses.

ENCE 672 Regional Transportation Planning (3)
Prerequisite: ENCE 471 or permission of both department and instructor. Factors involved and the components of the process for planning statewide and regional transportation systems, encompassing all modes. Transportation planning studies, statewide traffic models, investment models, programming and scheduling.

ENCE 673 Urban Transportation (3)
The contempory methodology of urban transportation planning. The urban transportation planning process, interdependence between the urban transportation system and the activity system, urban travel demand models, evaluation of urban transportation alternatives and their implementation.

ENCE 674 Urban Transit Planning and Rail Transportation Engineering (3)
Prerequisite: ENCE 471 or permission of both department and instructor. Basic engineering components of conventional and high speed railroads and of air cushion and other high speed new technology. The study of urban rail and bus transit. The characteristics of the vehicle, the supporting way, and the terminal requirements will be evaluated with respect to system performance, capacity, cost, and level of service.

ENCE 675 Airport Planning and Design (3)
Prerequisite: ENCE 471 or permission of both department and instructor. The planning and design of airports including site selection, runway configuration, geometric and structural design of the landing area, and terminal facilities. Methods of financing airports, estimates of aeronautical demand, air traffic control, and airport lighting are also studied.

ENCE 676 Highway Traffic Flow Theory (3)
Prerequisites: [ENCE 461; and ENCE 462] or permission of both department and instructor. An examination of physical and statistical laws that are used to represent traffic flow phenomena. Deterministic models including heat flow, fluid flow, and energy-momentum analogies, car following models, and acceleration noise. Stochastic approaches using independent and Markov processes, Queuing models, and probability distributions.

ENCE 677 Quantitative Methods in Transportation Engineering (3)
Applications of operations research and management science models to the planning, design and operations of various types of transportation systems. Equilibrium traffic assignment, network design, fleet assignment, fleet routing, crew scheduling, simulation, and queueing theory.

ENCE 681 Freight Transportation Analysis (3)
Application of operations research and system analysis methods to freight transportation systems. Cost and output analysis, terminal location, freight transportation demand models, freight transportation network equilibrium models and analytic models for analyzing the operations of rail, motor carrier, water carrier and air cargo systems.

ENCE 688 Advanced Topics in Civil Engineering (1-3)
Prerequisite: permission of both department and instructor. Advanced topics selected by the faculty from the current literature of civil engineering to suit the needs and background of students. May be taken for repeated credit when identified by topic title.

ENCE 689 Seminar (1-16)

ENCE 730 Environmental and Water Resource Systems II (3)
Prerequisite: ENCE 630 or permission of both department and instructor. Advanced topics in operational research. Applications to complex environmental and water resource systems. The use of systems simulation and probabalistic modeling.

ENCE 731 Advanced Ground Water Hydrology (3)
Prerequisite: ENCE 432 or equivalent. Theory and application of unsteady flow in porous media. Analysis of one and two dimensional unsteady flow. Solutions of non-linear equation of unsteady flow with a free surface. Development and use of approximate numerical and graphical methods in the study of ground water movement.

ENCE 732 Advanced Hydrologic Analysis (3)
Prerequisite: permission of both department and instructor. A critical examination of advanced data analysis and modeling techniques used in hydrology; stochastic-deterministic interfaces; trade-offs among lumped, linked system and spatially distributed models; sensitivity analysis in performance evaluation; model formulation; calibration and verification concepts.

ENCE 733 Applied Water Chemistry (4)
Three hours of lecture and one hour of laboratory per week. *Prerequisite: ENCE 633 or permission of both department and instructor.* A study of the chemistry of both municipal and industrial water treatment processes. Among the topics to be considered are water softening, stabilization, chemical destabilization of colloidal materials, ion exchange, disinfection, chemical oxidation and oxygenation reactions.

ENCE 735 Design of Municipal and Industrial Wastes Treatment Facilities (3)
One hour of lecture and two hours of laboratory per week. *Corequisite: ENCE 736 or equivalent.* Application of basic science and engineering science to design of municipal and industrial waste treatment processes; design and economics of unit operations as applied to environmental systems.

ENCE 736 Theory of Aqueous and Solid Waste Treatment and Disposal (3)
Prerequisites: ENCE 221 and fundamentals of microbiology; or permission of both department and instructor. Theory and basic principles of treating and handling waste products; hydraulics of sewers; biological oxidation; principles and design criteria of biological and physical treatment processes; disposal of waste sludges and solids.

ENCE 737 Industrial Wastes (3)
Corequisite: ENCE 736 or equivalent. A study of the characteristics of liquid wastes from major industries, and the processes producing the wastes. The theory and methods of eliminating or treating the wastes, and their effects upon municipal sewage-treatment plants, and receiving waters.

ENCE 738 Selected Topics in Porous Media Flow (3)
Prerequisite: ENCE 731. Repeatable to 6 credits. Analysis of two-liquid flows for immiscible fluids, simultaneous flow of two immiscible fluids and miscible fluids. Hydrodynamic dispersion theories, parameters of dispersion and solutions of some dispersion problems with emphasis on migration of pollutants.

ENCE 741 Aircraft Remote Sensing in Civil Engineering (3)
Prerequisite: ENCE 340 or equivalent; or permission of both department and instructor. Theoretical and practical aspects of the use of remote sensing in engineering. Emphasis on the interpretation of aerial photography and infrared, radar, multispectral and other sensor data. The planning of aerial and field remote sensing missions and the applications of these sensors to engineering programs including regional inventories, route locations, environmental surveys and site investigations. Computer analysis of remote sensing data is considered.

ENCE 742 Site Investigation (3)
Prerequisite: ENCE 340 or equivalent or permission of both department and instructor. A study of various techniques for evaluating the physical environment and performing exploration programs for engineering facilities. Methods for using various techniques available for engineering site investigations, including interpretation of topographic, geological and agricultural soil maps; and the use of geophysical and subsurface exploration systems.

ENCE 745 Advanced Pavement Design (3)
Fundamentals of recent mechanistic structural design approaches of flexible and rigid systems for highway and airfield pavements. The principles of probabilistic (reliability) design approaches, dynamic material characterization, theoretical stress solutions (multilayer and slab analysis) and fundamental distress criterion of material fatigue and deformability, integrated into a total structural design system framework.

ENCE 746 Pavement Management Systems (3)
The overall framework necessary to develop a Pavement Management System (PMS) at the project and network level. Major emphasis on the data collection, maintenance and rehabilitation phases of the systems concept. Pavement condition, performance, safety and structural evaluation . Maintenance and rehabilitation methodologies needed to develop life cycle costing of various alternative strategies.

ENCE 750 Analysis and Design of Structural Systems (3)
Prerequisites: ENCE 450; and ENCE 451 or equivalent. Review of classical determinate and indeterminate analysis techniques; numerical technique; multistory buildings; space structures; suspension bridges and cables structures; arches; long span bridges.

ENCE 751 Advanced Problems in Structural Behavior (3)
Prerequisite: ENCE 750 or equivalent. Elastic and inelastic behavior of structural members and frames; problems in torsion, stability and bending; open and closed thin-walled sections; curved girders.

ENCE 753 Reinforced Concrete Structures (3)
Prerequisites: ENCE 450; and ENCE 451 or equivalent. The behavior and strength of reinforced concrete members under combined loadings, including the effects of creep, shrinkage and temperature. Mechanisms of shear resistance and design procedures for bond, shear and diagonal tension. Elastic and ultimate strength analysis and design of slabs. Columns in multistory frames. Applications to reinforced concrete structures.

ENCE 754 Prestressed Concrete Structures (3)
Prerequisites: ENCE 450; and ENCE 451 or equivalent. Fundamental concepts of prestressed concrete. Analysis and design of flexural members including composite and continuous beams with emphasis on load balancing technique. Ultimate strength design for shear. Design of post tensioned flat slabs. Various applications of prestressing including tension members, compression members, circular prestressing, frames and folded plates.

ENCE 799 Master's Thesis Research (1-6)

ENCE 899 Doctoral Dissertation Research (1-8)

ENCH – Engineering, Chemical

ENCH 425 Transport Processes II: Heat Transfer (3)
Prerequisite: MATH 246. Pre- or corequisite: ENCH 280. Steady and unsteady state conduction, convective heat transfer, radiation, design of condensers, heat exchangers, evaporators, and other types of heat transfer equipment.

ENCH 427 Transport Processes III: Mass Transfer (3)
Prerequisite: ENCH 425. Steady and unsteady state molecular diffusion, inter-phase transfer, simultaneous heat and mass transfer, boundary layer theory, mass transfer and chemical reaction. Design applications in humidification, gas absorption, distillation, extraction, adsorption and ion exchange.

ENCH 437 Chemical Engineering Laboratory (3)
Prerequisites: ENCH 427; and ENCH 440; and ENCH 442. Application of chemical engineering process and unit operation principles in small scale semi-commercial equipment. Data from

experimental observations are used to evaluate performance and efficiency of operations. Emphasis on correct presentation of results in report form.

ENCH 440 Chemical Engineering Kinetics (3)
Prerequisites: ENCH 300; and ENCH 425; and CHEM 481. Fundamentals of chemical reaction kinetics and their application to the design and operation of chemical reactors. Reaction rate theory, homogeneous reactions and catalysis electrochemical reactions. Catalytic reactor design.

ENCH 442 Chemical Engineering Systems Analysis (3)
Prerequisites: ENCH 300; and ENCH 425. Dynamic response applied to process systems. Goals and modes of control, Laplace transformations, analysis and synthesis of simple control systems, closed loop response, dynamic testing.

ENCH 444 Process Engineering Economics and Design I (3)
Prerequisites: ENCH 427; and ENCH 440; and ENCH 442. Principles of chemical engineering economics and process design. Emphasis on equipment types, equipment design principles, capital cost estimation, operating costs, and profitability.

ENCH 446 Process Engineering Economics and Design II (3)
Prerequisite: ENCH 444. Not open to students who have completed ENCH 445. Application of chemical engineering principles for the design of chemical processing equipment. Typical problems in the design of chemical plants.

ENCH 450 Chemical Process Development (3)
Prerequisite: ENCH 427. Chemical process industries from the the standpoint of technology, raw materials, products and processing equipment. Operations of major chemical processes and industries combined with quantitative analysis of process requirements and yields.

ENCH 452 Advanced Chemical Engineering Analysis (3)
Prerequisite: ENCH 427. Application of digital and analog computers to chemical engineering problems. Numerical methods, programming, differential equations, curve fitting, amplifiers and analog circuits.

ENCH 453 Applied Mathematics in Chemical Engineering (3)
Prerequisite: ENCH 427. Mathematical techniques applied to the analysis and solution of chemical engineering problems. Use of differentiation, integration, differential equations, partial differential equations and integral transforms. Application of infinite series, numerical and statistical methods.

ENCH 454 Chemical Process Analysis and Optimization (3)
Prerequisites: ENCH 427; and ENCH 440. Applications of mathematical models to the analysis and optimization of chemical processes. Models based on transport, chemical kinetics and other chemical engineering principles will be employed. Emphasis on evaluation of process alternatives.

ENCH 468 Research (1-3)
Prerequisite: permission of both department and instructor. Repeatable to 6 credits. Investigation of a research project under the direction of a faculty member. Comprehensive reports are required.

ENCH 482 Biochemical Engineering (3)
Prerequisite: senior standing in engineering or permission of both department and instructor. Introduction to biochemical and microbiological applications to commerical and engineering processes, including industrial fermentation, enzymology, ultrafiltration, food and pharmaceutical processing and resulting waste treatment. Enzyme kinetics, cell growth, energetics and mass transfer.

ENCH 485 Biochemical Engineering Laboratory (2)
Pre- or corequisite: ENCH 482. Techniques of measuring pertinent parameters in fermentation reactors, quantification of production variables for primary and secondary metabolites such as

enzymes and antibiotics, the insolublization of enzymes for reactors, and the demonstration of separation techniques such as ultrafiltration and affinity chromatography.

ENCH 490 Introduction to Polymer Science (3)
Prerequisite: ENCH 425. The elements of the chemistry, physics, processing methods, and engineering applications of polymers.

ENCH 494 Polymer Technology Laboratory (3)
One hour of lecture and two hours of laboratory per week. *Prerequisite: ENCH 490 or ENCH 492.* Measurement of mechanical, electrical, optical, thermal properties of polymers, measurement of molecular weight by viscometry isometric and light scattering methods. Application of X-ray, NMR, ESR, spectroscopy molecular relaxation, microscopy and electron microscopy to the determination of polymer structure, effects of ultraviolet light and high energy radiation.

ENCH 496 Processing of Polymer Materials (3)
Prerequisite: ENCH 490 or ENCH 492. Credit will be granted for only one of the following: ENCH 496 or ENMA 496. A comprehensive analysis of the operations carried out on polymeric materials to increase their utility. Conversion operations such as molding, extrusion, blending, film forming, and calendering. Development of engineering skills required to practice in the high polymer industry.

ENCH 609 Graduate Seminar (1)

ENCH 610 Chemical Engineering Thermodynamics (3)
Advanced application of the general thermodynamic methods to chemical engineering problems. First and second law consequences; estimation and correlation of thermodynamic properties; phase and chemical reaction equilibria.

ENCH 620 Methods of Engineering Analysis (3)
Application of selected mathematical techniques to the analysis and solution of engineering problems; included are the applications of matrices, vectors, tensors, differential equations, integral transforms, and probability methods to such problems as unsteady heat transfer, transient phenomena in mass transfer operations, stagewise processes, chemical reactors, process control, and nuclear reactor physics.

ENCH 630 Transport Phenomena (3)
Heat, mass and momentum transfer theory from the viewpoint of the basic transport equations. Steady and unsteady state; laminar and turbulent flow; boundary layer theory, mechanics of turbulent transport; with specific application to complex chemical engineering situations.

ENCH 640 Advanced Chemical Reaction Kinetics (3)
The theory and application of chemical reaction kinetics to reactor design. Reaction rate theory; homogeneous batch and flow reactors; fundamentals of catalysis; design of heterogeneous flow reactors.

ENCH 648 Special Problems in Chemical Engineering (1-16)

ENCH 655 Radiation Engineering (3)
Prerequisite: permission of both department and instructor. An analysis of such radiation applications as synthesizing chemicals, preserving foods, control of industrial processes. Design of irradiation installations, e.g., Cobalt 60 Gamma ray sources, electronuclear machine arrangement, and chemical reactors.

ENCH 720 Process Analysis and Simulation (3)
Prerequisite: ENCH 630. Second semester. Development of mathematical models of chemical processes based on transport phenomena, chemical kinetics, and other chemical engineering methods. Emphasis on principles of model building and simulation utilizing mathematical solutions and computer methods.

ENCH 723 Process Engineering and Design (3)
Coordination of chemical engineering and economics to advanced process engineering and design. Optimization of investment and operating costs. Solution of typical problems encountered in the design of chemical engineering plants.

ENCH 730 Complex Equilibrium Stage Processes (3)
Second semester. The theory and application of complex equilibrium stages. Binary and multicomponent absorption; extraction; liquefaction.

ENCH 735 Chemical Process Dynamics (3)
Prerequisite: Differential equations or permission of both department and instructor. Analysis of open and closed control loops and their elements; dynamic response of processes; choice of variables and linkages; dynamic testing and synthesis; noise and drift; chemical process systems analysis; strategies for optimum operation. Fall semester.

ENCH 737 Chemical Process Optimization (3)
Techniques of modern optimization theory as applied to chemical engineering problems. Optimization of single and multivariable systems with and without constraints. Application of partial optimization techniques to complex chemical engineering processes. Spring semester.

ENCH 761 Enzyme Engineering (3)
Prerequisite: ENCH 640. Enzyme science and kinetics; principles of enzyme insolublization and denaturation with application to design, operation and modeling of enzyme reactors. The relationship between mass transfer and apparent kinetics in enzyme systems; and techniques of separation and purification of enzymes.

ENCH 762 Advanced Biochemical Engineering (3)
Prerequisite: ENCH 482 or permission of both department and instructor. Advanced topics to include use of a digital computer for mathematical modeling of the dynamics of biological systems; separation techniques for heat sensitive biologically active materials; and transport phenomena in biological systems.

ENCH 784 Polymer Physics (3)
Prerequisite: ENCH 490 or permission of both department and instructor. Application and correlation of mechanical and dielectric relaxation, NMR, electron microscopy, X-ray diffraction, diffusion and electrical properties to the mechanical properties and structure of polymers in the solid state.

ENCH 786 Polymer Processing and Applications (3)
Prerequisite: ENCH 490 or permission of both department and instructor. Application of theoretical knowledge of polymers to industrial processes. An analysis of polymerization, stabilization, electrical, rheological, thermal, mechanical and optical properties and their influence on processing conditions and end use applications.

ENCH 799 Master's Thesis Research (1-6)

ENCH 818 Advanced Topics in Thermodynamics (3)
Prerequisite: CHEM 604. Second semester.

ENCH 828 Advanced Topics in Chemical Reaction Systems (3)
Prerequisite: ENCH 640. First semester. Offered in alternate years.

ENCH 838 Advanced Topics in Transfer Theory (3)
Prerequisite: ENCH 720. First semester. Offered in alternate years.

ENCH 848 Advanced Topics in Separation Processes (3)
Second semester. Offered in alternate years.

ENCH 899 Doctoral Dissertation Research (1-8)

ENEE – Engineering, Electrical

ENEE 407 Microwave-circuits Laboratory (2)
One hour of lecture and three hours of laboratory per week. *Prerequisites: ENEE 305 and 381 and completion of all lower-division technical courses in the EE curriculum. See above note.* Experiments concerned with circuits constructed from microwave components providing practical experience in the design, construction and testing of such circuits. Projects include microwave filters and S-parameter design with applications of current technology.

ENEE 412 Advanced Electronics (3)
Prerequisite: ENEE 314 and completion of all lower-division technical courses in the EE curriculum. See above note. Design and analysis of tuned circuits, oscillators, VCO'S phase-locked loops, multipliers, modulators and A/D converters and their application in telemetry, communication and instrumentation.

ENEE 413 Electronics Laboratory (2)
One hour of lecture and three hours of laboratory per week. *Prerequisite: ENEE 305 and ENEE 314 and completion of all lower-division technical courses in the EE curriculum. See above note.* The specification, design and testing of basic electronic circuits and practical interconnections. Emphasis on design with discrete solid state and integrated circuit components for both analog and digital circuits.

ENEE 418 Projects in Electrical Engineering (1-3)
Hours to be arranged. *Prerequisites: permission of instructor and department and completion of all lower-division technical courses in the EE curriculum. See above note.* Theoretical and experimental projects.

ENEE 420 Communication Systems (3)
Prerequisite: ENEE 324 and completion of all lower-division technical courses in the EE curriculum. See above note. Fourier series, Fourier transforms and linear system analysis; random signals, autocorrelation functions and power spectral densities; analog communication systems: amplitude modulation, single-sideband modulation, frequency and phase modulation, sampling theorem and pulse-amplitude modulation; digital communication systems pulse-code modulation, phase-shift keying, differential phase shift keying, frequency shift keying; performance of analog and digital communication systems in the presence of noise.

ENEE 421 Information Theory and Coding (3)
Prerequisite: ENEE 324 and completion of all lower-division technical courses in the EE curriculum. See above note. Definition of information and entropy; Memoryless and Markov sources; source coding; Kraft and MacMillan inequalities; Shannon's first theorem; Hoffman Codes; Channels, Mutual Information, and Capacity; Shannon's Noisy Channel Coding Theorem; Error Correcting Codes.

ENEE 425 Digital Signal Processing (3)
Prerequisite: ENEE 322 and completion of all lower-division technical courses in the EE curriculum. See above note. Sampling as a modulation process; aliasing; the sampling theorem; the Z-transform and discrete-time system analysis; direct and computer-aided design of recursive and nonrecursive digital filters; the Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT); digital filtering using the FFT; analog-to-digital and digital-to analog conversion; effects of quantization and finite-word-length arithmetic.

ENEE 426 Communication Networks (3)
Prerequisite: permission of department and completion of all lower-division technical courses in the EE curriculum. See above note. The main design issues associated with ordinary, single-user, point-to-point communication systems and their juxtaposition to those involved in multi-user

systems such as computer networks, satellite systems, radio nets, and general communication networks. Application of analytical tools of queueing theory to design problems in such networks. Review of proposed architectures and protocols.

ENEE 434 Introduction to Neural Networks and Signals (3)
Prerequisite: ENEE 204 or ENEE 300 and completion of all lower-division technical courses in the EE curriculum. See above note. Introduction in the generation and processing of bioelectric signals including structure and function of the neuron, membrane theory, generation and propagation of nerve impulses, synaptic mechanisms, transduction and neural coding of sensory events, central nervous system processing of sensory information and correlated electrical signals, control of effector organs, muscle contraction and mechanics, and models of neurons and neural networks.

ENEE 435 Electrodes and Electrical Processes in Biology and Medicine (3)
Prerequisite: ENEE 204 or ENEE 300 and completion of all lower-division technical courses in the EE curriculum. See above note. Techniques for recording biological signals such as brain, muscle and cardial electrical potentials; membrane theory; half-cell potentials, liquid junction potentials, polarization of electrodes; biological and medical instrumentation; and applications in the design of cardial pacemakers, or a similar case study.

ENEE 438 Topics in Biomedical Engineering (1-3)
Prerequisite: permission of department and completion of all lower-division technical courses in the EE curriculum. See above note. Repeatable to 9 credits. The content may vary from semester to semester. Selected topics of current interest from such areas as bioelectric systems, modeling instrumentation, automated diagnostic, health-care delivery, etc.

ENEE 440 Microprocessors (3)
Prerequisite: ENEE 250 and completion of all lower-division technical courses in the EE curricilum. See above note. Microprocessor architectures, instruction sets, and applications. Bus structures, memory, I/O interfacing. Programming, and the embedding of microprocessors in other systems.

ENEE 442 Software Engineering (3)
Prerequisites: ENES 240; ENEE 250 or equivalent and completion of all lower-division technical courses in the EE curriculum. See above note. Architectural aspects of software engineering. Machine language and machine structure; assembly language and assemblers; macro-language and macro-processors; loaders and linkers; programming languages and language structure; compilers and interpreters; operating systems.

ENEE 444 Logic Design of Digital Systems (3)
Prerequisite: ENEE 250 and completion of all lower-division technical courses in the EE curriculum. See above note. Not open to students who have completed ENEE 244. Review of switching algebra; gates and logic modules; map simplification techniques; multiple-output systems; memory elements and sequential systems; large switching systems; iterative networks; sample designs, computer oriented simplification algorithms; state assignment; partition techniques; sequential system decompositions.

ENEE 445 Computer Laboratory (2)
One hour of lecture and three hours of laboratory per week. *Prerequisite: ENEE 305 and ENEE 440 or ENEE 444 and completion of all lower-division technical course in the EE curriculum. See above note.* Hardware oriented experiments providing practical experience in the design, construction, and checkout of components and interfaces for digital computers and data transmission systems. Projects include classical design techniques and applications of current technology.

ENEE 446 Digital Computer Design (3)
Prerequisite: ENEE 250 and completion of all lower-division technical courses in the EE curriculum. See above note. Hardware design of digital computers. Arithmetic and logic units, adders, multipliers and dividers. Floating-point arithmetic units. Bus and register structures. Control units, both hardwired and microprogrammed. Index registers, stacks, and other addressing schemes. Interrupts, DMA and interfacing.

ENEE 450 Discrete Structures (3)
Prerequisite: ENEE 350 and completion of all lower-division technical courses in the EE curriculum. See above note. Modern algebra with applications to computer and communications hardware. Relations, mappings, groups, rings and fields. Boolean algebras and lattice theory. Applications to digital logic desing, computer arithmetic and error-correcting codes.

ENEE 460 Control Systems (3)
Prerequisite: ENEE 322 and completion of all lower-division technical courses in the EE curriculum. See above note. Mathematical models for control system components. Transform and time domain methods for linear control systems. Introductory stability theory. Root locus, Bode diagrams and Nyquist plots. Design specifications in the time and frequency domains. Compensation design in the time and frequency domain. Introduction to sampled data systems. Introduction to computer aided design of control systems.

ENEE 461 Control Systems Laboratory (2)
One hour of lecture and three hours of laboratory per week. *Prerequisites: ENEE 305 and ENEE 460 and completion of all lower-division technical courses in the EE curriculum. See above note.* Projects to enhance the student's understanding of feedback control systems and to familiarize him with the characteristics and limitations of real control devices. Students will design, build, and test servomechanisms, and will conduct analog and hybrid computer simulations of control systems.

ENEE 462 Systems, Control and Computation (3)
Prerequisite: ENEE 322 and completion of all lower-division technical courses in the EE curriculum. See above note. Matrix algebra, state space analysis of discrete systems, state space analysis of continuous systems, computer algorithms for circuit analysis, optimization and system simulation.

ENEE 472 Electric Power System Components (3)
Prerequisite: ENEE 322; and ENEE 380; and completion of all lower-division technical courses in the EE curriculum. See above note. Linear and nonlinear magnetic circuits, hysteresis and eddy current losses, transformers, induction motors, synchronous generators.

ENEE 473 Electrical Machines Laboratory (2)
One hour of lecture and three hours of laboratory per week. *Prerequisite: ENEE 305 and completion of all lower-division technical courses in the EE curriculim. See above note.* Experiments involving single and three phase transformers, induction machines, synchronous machines and D.C. machines.

ENEE 474 Power Systems (3)
Prerequisite: ENEE 322 and completion of all lower-division technical in the EE curriculum. See above note. Interconnected power systems, transmission lines, load flow studies, unit commitment and economic dispatch. Three phase networks, machine models. Symmetrical components, fault analysis and unbalanced operation. Power system transients, stability and numerical methods in power system analysis.

ENEE 475 Power Electronics (3)
Prerequisite: ENEE 302 and completion of all lower-divisiona technical courses in the EE curriculum. See above note. Analytical methods, canonical circuit topologies, fundamentals of power semiconductors, snubbing circuits, drive circuits, fundamentals of control methods.

ENEE 476 Power System Stability (3)
Prerequisite: ENEE 322 and completion of all lower-division technical courses in the EE curriculum. See above note. Power system modeling, the swing equation. Lyapunov stability analysis. Construction of Lyapunov, or energy, function. The equal-area criterion. Critical clearing time. Potential energy boundry surface method. Emergency control. Recent developments.

ENEE 480 Fundamentals of Solid State Electronics (3)
Prerequisite: ENEE 381 and completion of all lower-division technical courses in the EE curriculum. See above note. Review of Maxwell's equation, electromagnetic properties of dielectrics; introduction to quantum mechanics and quantum statistics; classical and quantum theory of metals; theory of semiconductors and semiconductor devices; principle of magnetic devices and selected topics.

ENEE 481 Antennas (3)
Prerequisite: ENEE 381 and completion of all lower-division technical courses in the EE curriculum. See above note. Introduction to the concepts of radiation, generalized far field formulas; antenna theorems and fundamentals; antenna arrays, linear and planar arrays; aperture antennas; terminal impedance; propagation.

ENEE 482 Design of Active and Passive Microwave Devices (3)
Prerequisite: ENEE 381 and completion of all lower-division technical courses in the EE curriculum. See above note. Design and operation of passive and active microwave devices. The passive components include waveguides, resonators, and antennas. The active devices include klystrons, magnetrons, gyrotrons, and free electron lasers.

ENEE 483 Electromagnetic Measurements Laboratory (2)
One hour of lecture and three hours of laboratory per week. *Prerequisites: ENEE 305 and ENEE 380 and completion of all lower-division technical courses in the EE curriculum. See above note.* Experiments designed to provide familiarity with a large class of micro-wave and optical components, techniques for interconnecting them into useful systems, and techniques of high frequency and optical measurements.

ENEE 488 Topics in Electrical Engineering (3)
Prerequisite: permission of department and completion of all lower-division technical courses in the EE curriculum. See above note. Selected topics of current importance in electrical engineering.

ENEE 494 Solid State Devices (3)
Prerequisite: ENEE 302 and completion of all lower-division technical courses in the EE curriculum. See above note. Introduction to semiconductor materials; p-n junctions; metal-semiconductor contacts; bipolar transistors, insulated gate field effect transistors; and related selected topics.

ENEE 495 Integrated Circuit Technology (3)
Prerequisite: ENEE 494 and completion of all lower-division technical courses in the EE curriculum. See above note. Introduction to the fabrication technologies for integrated circuits including oxidation, diffusion, and photolithography; concepts of bipolar and MOS device design; layout of simple digital ICs.

ENEE 496 Lasers and Electro-optic Devices (3)
Pre- or corequisite: ENEE 381. Completion of all lower-division technical courses in the EE curriculum. See above note. Optical resonators, fabry-perot etalon. Theory of laser oscillation, rate equations. Gaseous, solid state, semiconductor and dye laser systems. Electro-optic effects and parametric oscillators. Holography.

ENEE 608 Graduate Seminar (1-3)
Prerequisite: permission of instructor. Every semester regular seminars are held in electrical science and in the six areas of specialization offered by the electrical engineering department. They may be taken, by arrangement with the student's advisor, for repeated credit.

ENEE 609 Projects in Electrical Engineering (1-3)
Prerequisite: permission of instructor. Repeatable to 3 credits. Individual projects on advanced systems in electrical engineering.

ENEE 610 Electrical Network Theory (3)
Prerequisite: Undergraduate circuit theory or permission of instructor. Matrix algebra, network elements, ports, passivity and activity, geometrical and analytical descriptions of networks, state variable characterizations, scattering matrices, signal flow graphs, sensitivity.

ENEE 620 Random Processes in Communication and Control (3)
Prerequisite: ENEE 324 or equivalent. Introduction to random processes: characterization, classification, representation; Gaussian and other examples. Linear operations on random processes, stationary processes: covariance function and spectral density. Linear least square waveform estimating Wiener-Kolmogroff filtering, Kalman-Bucy recursive filtering: function space characterization, non-linear operations on random processes.

ENEE 621 Estimation and Detection Theory (3)
Prerequisite: ENEE 620 or equivalent. Also offered as MAPL 644. Estimation of unknown parameters, Cramer-Rao lower bound; optimum (map) demodulation; filtering, amplitude and angle modulation, comparison with conventional systems; statistical decision theory Bayes, minimax, Neyman/Pearson, Criteria-68 simple and composite hypotheses; application to coherent and incoherent signal detection; M-ary hypotheses; application to uncoded and coded digital communication systems.

ENEE 623 Digital Communications (3)
Prerequisites: ENEE 620 and ENEE 420 or equivalents, or permission of instructor. Review of sampling and quantization, functional characterization of digital signals and transmission facilities, band-limited signals and systems. Digital modulation/demodulation techniques, error probability, intersymbol interference and its effects, adaptive equalization. Signaling with coded waveforms, fading and satellite channels, multiple access problems and protocols. Introduction to spread-spectrum Communications.

ENEE 625 Multi-user Communication (3)
Prerequisite: ENEE 620. Basic queueing models. Store-and forward communications networks; switching modes; delay-throughput measures; capacity assignment; routing; topological design; computational aspects; flow control; error control; protocols; specification and validation; local networks; satellite and packet radio systems; multiple access schemes; stability and performance; multi-user information theory; and large scale system theory.

ENEE 633 Modeling of Nerves and Muscles With Applications to Prosthetic Devices (3)
Prerequisite: undergraduate degree in engineering or physics, or permission of instructor. Principles and circuit models for resting and active membrane potentials of nerves and muscles; synaptic mechanisms including probabilistic models of neuromuscular transmission; electrode potentials and reactions; propagation of biopotentials in a volume conductor; properties, mechanical models, and circuit analogs for muscles and proprioceptors; spinal reflexes in the control of posture; applications of the above in the design of prosthetic and orthotic devices.

ENEE 634 Models of Transduction and Signal Processing in Sensory Systems (3)
Prerequisite: ENEE 633 or ENEE 435 or permission of instructor. General organization of sensory systems; receptor mechanisms; receptor and neural models; statistics of neural spike trains; peripheral signal processing in sensory systems, with emphasis on vision and audition; introduction to signal processing in the central nervous system; applications to development of sensory protheses.

ENEE 642 Software System Implementation (3)
Prerequisite: ENEE 442 or equivalent. Implementation aspects of software engineering. Programming languages; architectural designs; program design; structured programming; peripheral storage devices; I/O programming; debugging and evaluation.

ENEE 646 Digital Computer Design (3)
Prerequisite: ENEE 446. Introduction to design techniques for digital computers; digital arithmetic; logic circuits; digital memories; design of computer elements; arithmetic unit; and control unit. A simple digital computer will be designed.

ENEE 648 Advanced Topics in Electrical Engineering (3)
Every semester courses intended for high degree of specialization are offered by visiting or regular electrical engineering faculty members in two or more of the areas listed in 488. The student should check with the electrical engineering office of graduate studies for a list and the description of the topics offered currently.

ENEE 654 Combinatorial Switching Theory (3)
Prerequisites: ENEE 450 and ENEE 444. Application of algebraic techniques to combinatorial switching networks; multi-valued systems; symmetries and their use; optimization algorithms; heuristic techniques; majority and threshold logic; function decomposition; cellular cascades.

ENEE 655 Structure Theory of Machines (3)
Prerequisites: ENEE 450 and ENEE 444. Machine realizations; partitions and the substitution property; pair algebras and applications; variable dependence; decomposition; loop-free structures; set system decompositions; semigroup realizations.

ENEE 660 Modern Control System Design Method (3)
Prerequisites: ENEE 663 and ENEE 620, or equivalent, or permission of instructor. Applications of state space design methods; linear regulator problem and applications to tracking, stabilization and disturbance elimination; self-tuning regulators. State estimators. The second method of Liapunov and applications in contol systems design. Applications of modern frequency domain methods in control system design; diagonal dominance, dynamic compensation, decoupling. Applications of the linear quadratic Gaussian problem in control systems design. Case studies from industrial, guidance and other engineering control problems. Analysis of computer algorithms are analyzed for each of the above four basic design methods provided. Analysis of interactive computer aided design methods and validation procedures are extensively analyzed.

ENEE 661 Nonlinear Control Systems (3)
Prerequisite: ENEE 460 or permission of instructor. State space methods of stability analysis including second order systems and the phase plane, linearization and stability in the small, stability in the large and Lyapunov's second method. Frequency domain methods including the describing function. Popov's method and functional analytic methods. Introduction to Volterra series representations of nonlinear systems. Applications to conrol system design.

ENEE 663 System Theory (3)
Also offered as MAPL 640. General systems models. State variables and state spaces. Differential dynamical systems. Discrete time systems. Linearity and its implications. Controllability and observability. State space structure and representation. Realization theory and algorithmic solutions. Parameterizations of linear systems; canonical forms. Basic results from stability theory. Stabilizability. Fine structure of linear multivariable systems; minimal indices and polynomial matrices. Inverse nyquist array. Geometric methods in design. Interplay between frequency domain and state space design methods. Interactive computer-aided design methods.

ENEE 664 Optimal Control (3)
Prerequisite: ENEE 460. Also offered as MAPL 641. General optimization and control problems. Static optimization problems. Linear and nonlinear programming methods. Geometric interpretations. Dynamic optimization problems. Discrete time maximum principle and applications. Pontryagin maximum principle in continuous time. Dynamic-programming. Feedback realization of solutions. Extensive applications to problems in optimal design, navigation and guidance, power systems. Introduction to state constrained and singular optimal control problems.

ENEE 665 Linear System Identification (3)
Prerequisites: MATH 400 and ENEE 322 or equivalent ENEE 6200 representations for linear systems. Parameter estimation techniques such as least square and maximum likelihood. Correlation methods with white noise inputs. Stochastic approximation and gradient algorithms. Applications of quarilinearization and invariant imbedding. Effect of abrevation noise.

ENEE 680 Electromagnetic Theory I (3)
Prerequisite: ENEE 381 or equivalent. Theoretical analysis and engineering applications of Maxwell's equations. Boundary value problems of electrostatics and magnetostatics.

ENEE 681 Electromagnetic Theory II (3)
Prerequisite: ENEE 381 or equivalent. Continuation of ENEE 680. Theoretical analysis and engineering applications of Maxwell's equations. The homogeneous wave equation. Plane wave propagation. The interaction of plane waves and material media. Retarded potentials. The Hertz potential. Simple radiating systems. Relativisitic covariance of Maxwell's equations.

ENEE 686 Charged Particle Dynamics, Electron and Ion Beams (3)
Prerequisite: permission of instructor. General principles of single-particle dynamics; mapping of the electric and magnetic fields; equation of motion and methods of solution; production and control of charge particle beams; electron optics; Liouville's theorem; space charge effects in high current beams; design principles of special electron and ion beam devices.

ENEE 690 Quantum and Wave Phenomena with Electrical Application (3)
Prerequisites: ENEE 381 and ENEE 382 or equivalent. Introduction of quantum and wave phenomena from electrical engineering point of view. Topics included: general principles of quantum mechanics, operator algebra, the microwave resonant cavity and the analagous potential well problem, harmonic oscillator, hydrogenic atom. Perturbation method applied to the transmission line and potential well problems. Periodically loaded transmission line and Kronig-Penny model of band theory.

ENEE 696 Integrated and Microwave Electronics (3)
Prerequisite: ENEE 310. Recommended: ENEE 793. Active and passive elements used in semiconductor structures. Design application of linear and digital integrated circuits.

ENEE 697 Semiconductor Devices and Technology (3)
Prerequisite: ENEE 496 or equivalent. Recommended: ENEE 793. The principles, structures and characteristics of semiconductor devices. Technology and fabrication of semiconductor devices.

ENEE 703 Semiconductor Device Models (3)
Prerequisite: ENEE 605 or equivalent. Single-frequency models for transistors; small-signal and wide-band models for general non-reciprocal devices, hybrid-PI and TEE models for transistors; relationship of models to transistor physics; synthesis of wide-band models from terminal behavior, computer utilization of models for other semiconductor devices.

ENEE 721 Information Theory (3)
Corequisite: ENEE 620. Prerequisite: STAT 400 or equivalent. Also offered as MAPL 731. Information measure, entropy, mutual information; source encoding; noiseless coding theorem, noisy coding theorem; exponential error bounds; introduction to probabilistic error correcting codes, block and convolutional codes and error bounds; channels with memory; continuous channels; rate distortion function.

ENEE 722 Error Correcting Codes (3)
Also offered as MAPL 732. Introduction to linear codes; bounds on the error correction capabilities of codes; convolutional codes with threshold, sequential and viterbi decoding; cyclic random error correcting codes; P-N sequences; cyclic and convolutional burst error correcting codes.

ENEE 724 Digital Signal Processing (3)
Prerequisite: ENEE 620 or permission of instructor. Review of Z transforms; correlations functions and power spectral densities for discrete time stochastic proces¯: discrete time Wiener filters; methods for designing digital filters to meet precise frequency domain specifation; effects of truncation, round-off and finite word length arithmetic on the accuracy and stability of digital filters; adaptive equalizers for narrow band data channels; discrete fourier transform ans fast fourier transform; homomorphic filtering; Gauss-Markov estimates; spectral density estimation.

ENEE 728 Advanced Topics in Communication Theory (3)
Topics selected, as announced, from advanced communication theory and its applications.

ENEE 730 Advanced Topics: Radar Signals and Systems (3)
Prerequisite: ENEE 620 or equivalent. The theory of imagine radar systems. Classiciations, resolution mechanisms, and principles. System design for additive noise: effects of ambiguity, multiplicative noise, motion errors, nonlinearities, and scattering mechanism. System design for ambiguity and multiplicative noise. Optical processing. Application to synthetic aperture, astronomical, and hologram radar.

ENEE 746 Digital Systems Engineering (3)
Prerequisite: ENEE 646. Systems aspects of digital-computer-based systems; data flow analysis; system organization; control languages; consoles and displays; remote terminals; software-hardware tradeoff; system evaluation; case studies from selected applications areas such as data acquisition and reduction information storage, or the like.

ENEE 748 Topics in Computer Design (1-3)
Such topics as computer arithmetic, computer reliability, and threshold logic will be considered. May be taken for repeated credit.

ENEE 761 Control of Distributed Parameter Systems (3)
Prerequisite: an introductory course in functional analytic methods at the level of ENEE 760, and background in control and system theory. Also offered as MAPL 741. Study of systems governed by paritial differential equations. Delay systems. Boundary and distributed control, Lyapunov stability. Optimal control of systems governed by paritial differential equations and of delay systems. Applications to continuum mechanics, distributed networks, biology, economics, and engineering.

ENEE 762 Stochastic Control (3)
Prerequisite: ENEE 620 or equivalent; and ENEE 663/MAPL 640. Also offered as MAPL 742. Stochastic control systems, numerical methods for the Ricatti equation, the separation principle, control of linear systems with Gaussian signals and quadratic cost, non-linear stochastic control, stochastic stability, introduction to stochastic games.

ENEE 769 Advanced Topics in Control Theory (3)
Topics selected, as announced, from advanced control theory and its applications.

ENEE 772 Advanced Methods and Algorithms in Detection and Filtering (3)
Prerequisite: ENEE 621. Also offered as MAPL 735. Foundations of random processes. Conditional expectations. Markov processes and Martingales. Ito calculus. Detection and estimation of continuous signals with continuous observations. Jump processes. Detection and estimation with discontinuous observations. Discrete-time case. Fast algorithms for digital filtering problems.

ENEE 780 Microwave Engineering (3)
Prerequisite: ENEE 681. Mathematical methods for the solution of the wave equation, transmission lines and waveguides, selected topics in the theory of waveguide structures, surface guides and artificial dielectrics.

ENEE 781 Optical Engineering (3)
Fourier analysis in two dimensions, diffraction theory, optical imaging systems, spatial flitering, holography.

ENEE 790 Quantum Electronics I (3)
Prerequisite: a knowledge of quantum mechanics or permission of instructor. Spontaneous emission, interaction of radiation and matter, masers, optical resonators, the gas, solid and semiconductor lasers, electro-optical effect, propagation in anisotropic media and light modulation.

ENEE 791 Quantum Electronics II (3)
Nonlinear optical effects and devices, tunable coherent light sources: optical parametric oscillator; frequency conversion and dye laser. Ultrashort pulse generation and measurement, stimulated raman effect, and applications. Interaction of acoustic and optical waves, and holography.

ENEE 793 Solid State Electronics (3)
Prerequisite: a graduate course in quantum mechanics or permission of instructor. Properties of crystals; energy bands: electron transport theory; conductivity and hall effect; statistical distributions; fermi level: impurities; non-equilibrium carrier distributions; normal modes of vibration; effects of high electric fields; P-N junction theory, avalanche breakdown; tunneling phenomena; surface properties.

ENEE 799 Master's Thesis Research (1-6)

ENEE 899 Doctoral Dissertation Research (1-8)

ENES – Engineering Science

ENES 405 Power and the Environment (3)
Intended for seniors not majoring in engineering. Not applicable as a technical elective for engineering majors. An introduction to the power needs of society. The interrelationship between man's use of energy and the effect on the eco-system. Introduction to the techniques of power production with special emphasis on nuclear-fueled power plants.

ENFP – Engineering, Fire Protection

ENFP 411 Fire Protection Hazard Analysis (3)
Prerequisites: ENFP 251; and ENFP 315. Appraisal and measurement of fire safety. Application of systems analysis, probability theory, engineering economy, and risk management in the identification and synthesis of components of fire protection engineering. Methods for the development of criteria for the design, evaluation and assessment of fire safety or component hazards.

ENFP 415 Fire Dynamics (3)
Prerequisites: ENCH 300 or ENME 320; and ENCE 330 or ENME 342; and ENFP 312 or permission of department. Introduction to premixed and diffusion flames; ignition, flame spread and rate of burning; fire plumes; flame radiation.

ENFP 416 Problem Synthesis and Design (3)
Senior standing. Techniques and procedures of problem orientation and solution design utilizing logical and numerical procedures. Student development of research projects in selected areas.

ENFP 421 Functional and Life Safety Analysis (3)
Prerequisites: ENFP 320; and ENFP 315. The function and life safety components of buildings. Analytical concepts and research related to modular loss analysis. The physical and psychological variables of fire casualties using techniques of system analysis. Current research related to egress and smoke movement. Performance criteria of building and fire prevention codes.

ENFP 489 Special Topics (3)
Prerequisite: permission of department. Repeatable to 6 credits. Selected topics of current importance to fire protection.

ENGL – English

ENGL 402 Chaucer (3)

ENGL 403 Shakespeare (3)
Early period – histories and comedies.

ENGL 404 Shakespeare (3)
Late period – tragedies and romances.

ENGL 407 Literature of the Renaissance (3)

ENGL 410 Edmund Spenser (3)

ENGL 412 Literature of the Seventeenth Century, 1600-1660 (3)

ENGL 414 Milton (3)

ENGL 415 Literature of the Seventeenth Century, 1660-1700 (3)

ENGL 416 Literature of the Eighteenth Century (3)
Age of Pope and Swift.

ENGL 417 Literature of the Eighteenth Century (3)
Age of Johnson and the Preromantics.

ENGL 418 Major British Writers (3)
Repeatable to 9 credits if content differs. Two writers studied intensively each semester.

ENGL 419 Major British Writers (3)
Repeatable to 9 credits if content differs. Two writers studied intensively each semester.

ENGL 420 Literature of the Romantic Period I (3)
Credit will be granted for only one of the following: either ENGL 320 or ENGL 420; or ENGL 320 or ENGL 421. First generation: Blake, Wordsworth, Coleridge, et al.

ENGL 421 Literature of the Romantic Period (3)
Credit will be granted for only one of the following: either ENGL 320 or ENGL 420; or ENGL 320 or ENGL 421. Second generation: Keats, Shelley, Byron, et al.

ENGL 422 Literature of the Victorian Period (3)
Early years.

ENGL 423 Literature of the Victorian Period (3)
Middle years.

ENGL 424 Late Victorian and Edwardian Literature (3)
A study of the literary movements and techniques which effected the transition from Victorian to modern literature.

ENGL 425 Modern British Literature (3)
An historical survey of the major writers and literary movements in English prose and poetry since 1900.

ENGL 430 American Literature, Beginning to 1810, the Colonial and Federal Periods (3)
ENGL 431 American Literature, 1810 to 1865, the American Renaissance (3)

ENGL 432 American Literature, 1865 to 1914, Realism and Naturalism (3)
Prerequisite: two literature courses.

ENGL 433 American Literature, 1914 to the Present, the Modern Period (3)

ENGL 434 American Drama (3)

ENGL 435 American Poetry: Beginning to the Present (3)

ENGL 437 Contemporary American Literature (3)
A survey of the poetry, prose, and drama written in America in the last decade.

ENGL 438 Major American Writers Before 1865 (3)
Repeatable to 9 credits if content differs. Two writers studied intensively each semester.

ENGL 439 Major American Writers After 1865 (3)
Repeatable to 9 credits if content differs. Two writers studied intensively each semester.

ENGL 440 The Novel in America to 1910 (3)

ENGL 441 The Novel in America Since 1910 (3)

ENGL 442 Literature of the South (3)
A historical survey, from eighteenth-century beginnings to the present.

ENGL 443 Afro-American Literature (3)
An examination of the literary expression of the black American in the United States, from its beginning to the present.

ENGL 445 Modern British and American Poetry (3)
Prerequisite: permission of department required for students with credit in ENGL 345. A study of the formation of the "Modern Tradition" in British and American poetry, exploring the distinctive energy and consciousness in the poets of the early twentieth century (1896-1930). Special emphasis on Hopkins, Yeats, Pound, Eliot, and Stevens. Collateral readings in essays on modern poetics, and in other poets of the period.

ENGL 446 Contemporary British and American Poetry (3)
Prerequisite: permission of department required for students with credit in ENGL 345. A study of British and American poetry from the Depression to the present. Special emphasis on Auden, Williams, Dylan Thomas, Theodore Roethke, Robert Lowell. A more general study of the work of some of these: Berryman, Jarrell, Fuller, Bishop, Wright, Kinnell, Larkin and including the projectivists, the beats and the present scene.

ENGL 447 Satire (3)
An introduction to English and American satire from Chaucer to the present.

ENGL 449 Playwriting (3)

ENGL 450 Elizabethan and Jacobean Drama (3)
Beginnings to Marlowe.

ENGL 451 Elizabethan and Jacobean Drama (3)
Jonson to Webster.

ENGL 452 English Drama From 1660 to 1800 (3)

ENGL 453 Literary Criticism (3)

ENGL 454 Modern Drama (3)

ENGL 455 The English Novel (3)
Eighteenth century.

ENGL 456 The English Novel (3)
Nineteenth century.

ENGL 457 The Modern Novel (3)

ENGL 461 Folk Narrative (3)
Studies in legend, tale and myth.

ENGL 462 Folksong and Ballad (3)

ENGL 463 American Folklore (3)
An examination of American folklore in terms of history and regional folk cultures. Exploration of collections of folklore from various areas to reveal the difference in regional and ethnic groups as witnessed in their oral and literary traditions.

ENGL 464 Afro-American Folklore and Culture (3)
An examination of the culture of the black American in the United States in terms of history (antebellum to the present) and social changes (rural to urban). Exploration of aspects of black culture and history via oral and literary traditions and life histories.

ENGL 466 Arthurian Legend (3)
Development of the Arthurian legend of heroism and love in English literature from medieval to modern times.

ENGL 476 Modern Fantasy and Science Fiction (3)
Major works of fantasy and science fiction since the mid-eighteenth century, emphasizing their continuity and their relationships to philosophical speculation, scientific discovery, literary history and cultural change.

ENGL 477 Studies in Mythmaking (3)
Major themes, figures, and configurations of northern European mythology, examining the value of the mythic mode of thought in a scientific era.

ENGL 478 Selected Topics in English and American Literature Before 1800 (1-3)
Repeatable if content differs.

ENGL 479 Selected Topics in English and American Literature After 1800 (3)
Repeatable if content differs.

ENGL 482 History of the English Language (3)

ENGL 483 American English (3)

ENGL 484 Advanced English Grammar (3)
Credit will be granted for only one of the following: ENGL 484 or LING 402.

ENGL 486 Introduction to Old English (3)
An introduction to the grammar, syntax, and phonology of Old English. Selected readings from Old English prose and poetry.

ENGL 489 Special Topics in English Language (3)
Repeatable to 9 credits if content differs. Studies in topics of current interest.

ENGL 493 Advanced Expository Writing (3)

ENGL 494 Editing and Document Design (3)
Prerequisite: ENGL 391, ENGL 393 or equivalent. For ENGL majors only. Principles of general editing for clarity, precision and correctness. Applications of the conventions of grammar, spelling, punctuation and usage, and organization for logic and accuracy. Working knowledge of the professional vocabulary of editing applied throughout the course.

ENGL 498 Advanced Fiction Workshop (3)
Prerequisite: permission of department. Repeatable to 9 credits. Formerly ENGL 496. Student criticism of student stories or chapters of novels-in-progress. Craft, execution, and technique. Intensive reading of anthologies and individual works in modern and contemporary fiction. Theoretical and critical works that help to define and analyze the context of the tradition.

ENGL 499 Advanced Poetry Writing Workshop (3)
Prerequisite: permission of department. Repeatable to 9 credits. Formerly ENGL 497. Student criticism of student work within the context of craft, technique, and execution. Relationship to Anglo-American and International Post-Modernist poetry.

ENGL 601 Literary Research and Critical Contexts (3)

ENGL 602 Middle English (3)

ENGL 603 Readings in English Language History (3)
An historical survey of the syntactic, lexical, and phonological patterns of English from Old English and its sources in Germanic and Indo-European through modern English.

ENGL 604 Old English (3)
Grammar, syntax, phonology and prosody of Old English. Designed to give graduate students a working knowledge of Old English and to introduce them to the major Old English texts in the original.

ENGL 605 Readings in Linguistics (3)
A survey of theoretical and applied linguistics.

ENGL 607 Readings in the History of Rhetorical Theory to 1900 (3)
Earlier theories of effective written discourse surveyed historically and as influenced by ethical, technical, and social change.

ENGL 611 Approaches to College Composition (3)
Required for graduate assistants (optional to other graduate students). A seminar emphasizing rhetorical and linguistic foundations for the handling of a course in freshman composition.

ENGL 612 Approaches to Professional and Technical Writing (3)
A pedagogical approach to professional and technical writing, its history and methodolgy.

ENGL 620 Readings in Medieval English Literature (3)

ENGL 621 Readings in Renaissance English Literature (3)

ENGL 622 Readings in Seventeenth-Century English Literature (3)

ENGL 623 Readings Eighteenth-Century English Literature (3)

ENGL 624 Readings in English Romantic Literature (3)

ENGL 625 Readings in English Victorian Literature (3)

ENGL 626 Readings in American Literature Before 1865 (3)

ENGL 627 Readings in American Literature, 1865-1914 (3)

ENGL 630 Readings in 20th Century English Literature (3)

ENGL 631 Readings in 20th Century American Literature (3)

ENGL 666 Readings in Modern Literary Theory (3)
Formerly ENGL 757.

ENGL 688 Poetry Workshop (3)
Prerequisite: permission of department. Poetry workshop.

ENGL 689 Fiction Workshop (3)
Prerequisite: permission of department. Fiction workshop.

ENGL 699 Independent Study (1-3)
Prerequisites: departmental approval of research project; and permission of instructor.

ENGL 718 Seminar in Medieval Literature (3)

ENGL 719 Seminar in Renaissance Literature (3)

ENGL 728 Seminar in Seventeenth-Century Literature (3)

ENGL 729 Seminar in Eighteenth-Century Literature (3)

ENGL 738 Seminar in Nineteenth-Century Literature (3)

ENGL 739 Seminar in Nineteenth-Century Literature (3)

ENGL 748 Seminar in American Literature (3)

ENGL 749 Studies in Twentieth-Century Literature (3)

ENGL 758 Literary Criticism and Theory (3)

ENGL 759 Seminar in Literature and the Other Arts (3)

ENGL 768 Studies in Drama (3)

ENGL 769 Studies in Fiction (3)

ENGL 775 Seminar in Composition Theory (3)
Readings and research in recent theories of effective writing.

ENGL 778 Seminar in Folklore (3)

ENGL 779 Seminar in Language Study (3)
Seminar in linguistic aspects of literature and composition.

ENGL 788 Studies in the English Language (3)
Repeatable to 9 credits.

ENGL 789 Form and Theory in Fiction (3)
Prerequisite: permission of department. A variety of prose modes (mediations, psychological studies, reportage myths, collage, magic realism, satire, etc.). Some of the writers to be read include Kafka, Cather, Barth, Kundera, and Barthelme.

ENGL 799 Master's Thesis Research (1-6)

ENGL 819 Seminar in Themes and Types in English Literature (3)

ENGL 828 Seminar in Themes and Types in American Literature (3)

ENGL 899 Doctoral Dissertation Research (1-8)

ENMA – Engineering, Materials

ENMA 462 Deformation of Engineering Materials (3)
Prerequisite: ENES 230 or permission of both department and instructor. Relationship of structure to the mechanical properties of materials. Elastic and plastic deformation, microscopic yield criteria, state of stress and ductility. Elements of dislocation theory, work hardening, alloy strengthening, creep, and fracture in terms of dislocation theory.

ENMA 463 Chemical, Liquid and Powder Processing of Engineering Materials (3)
Prerequisite: ENES 230 or permission of both department and instructor. Methods and processes used in the production of primary metals. The detailed basic principles of beneficiation processes, pyrometallurgy, hydrometallurgy, electrometallurgy, vapor phase processing and electroplating. Liquid metal processing including casting, welding, brazing and soldering. Powder processing and sintering. Shapes and structures produced in the above processes.

ENMA 464 Environmental Effects on Engineering Materials (3)
Prerequisite: ENES 230 or permission of both department and instructor. Introduction to the phenomena associated with the resistance of materials to damage under severe environmental conditions. Oxidation, corrosion, stress corrosion, corrosion fatigue and radiation damage are examined from the point of view of mechanism and influence on the properties of materials. Methods of corrosion protection and criteria for selection of materials for use in radiation environments.

ENMA 470 Structure and Properties of Engineering Materials (3)
A comprehensive survey of the atomic and electronic structure of solids with emphasis on the relationship of structure to the physical and mechanical properties.

ENMA 471 Physical Chemistry of Engineering Materials (3)
Equilibrium multicomponent systems and relationship to the phase diagram. Thermodynamics of polycrystalline and polyphase materials. Diffusion in solids, kinetics of reactions in solids.

ENMA 472 Technology of Engineering Materials (3)
Relationship of properties of solids to their engineering applications. Criteria for the choice of materials for electronic, mechanical and chemical properties. Particular emphasis on the relationships between structure of the solid and its potential engineering application.

ENMA 473 Processing of Engineering Materials (3)
The effect of processing on the structure of engineering materials. Processes considered include refining, melting and solidification, purification by zone refining, vapor phase processing, mechanical working and heat treatments.

ENMA 489 Selected Topics in Engineering Materials (3)
Prerequisite: permission of department. Repeatable to 12 credits if content differs. To introduce basic concepts such as crystal chemistry, defect chemistry and temary phase equilibria which can also be used to illustrate the various types of advanced ceramics (superconductors; superionic

conductors; dielectrics including ferroeletrics; optical materials; high temperature structural materials; etc.) and allow an understanding of their behaviors.

ENMA 495 Rheology of Engineering Materials (3)
Prerequisite: ENES 230 or permission of both department and instructor. Credit will be granted for only one of the following: ENMA 495 or ENCH 495. Study of the deformation and flow of engineering materials and its relationship to structural type. Elasticity, viscoelasticity, anelasticity and plasticity of single phase and multiphase materials.

ENMA 496 Polymeric Engineering Materials (3)
Prerequisite: ENES 230. Credit will be granted for only one of the following: ENMA 496 or ENCH 496. A comprehensive summary of the fundamentals of particular interest in the science and applications of polymers. Polymer single crystals, transformations in polymers, fabrication of polymers as to shape and internal structure.

ENMA 650 Structure of Engineering Materials (3)
Prerequisite: ENMA 470 or equivalent. The structural aspects of crystalline and amorphous solids and relationships to bonding types. Point and space groups. Summary of diffraction theory and practice. The reciprocal lattice. Relationships of the microscopically measured properties to crystal symmetry. Structural aspects of defects in crystalline solids.

ENMA 651 Electronic Structure of Engineering Materials (3)
Prerequisite: ENMA 650. Electronic and magnetic materials in relationship to their applications. Metallic conductors, resistive alloys, superconducting materials, semiconductors, hard and soft magnetic materials, piezo-electric and piezo-magnetic materials, optical materials. Emphasis on relationships between electronic configuration, crystal structure, defect structure and physical properties.

ENMA 659 Special Topics in Structure of Engineering Materials (3)
Prerequisite: permission of both department and instructor.

ENMA 660 Chemical Physics of Engineering Materials (3)
Prerequisite: ENMA 650. Thermodynamics and statistical mechanics of engineering solids. Cohesion, thermodynamic properties. Theory of solid solutions. Thermodynamics of mechanical, electrical, and magnetic phenomena in solids. Chemical thermodynamics, phase transitions and thermodynamic properties of polycrystalline and polyphase materials. Thermodynamics of defects in solids.

ENMA 661 Kinetics of Reactions in Materials (3)
Prerequisite: ENMA 660. The theory of thermally activated processes in solids as applied to diffusion, nucleation and interface motion. Cooperative and diffusionless transformations. Applications selected from processes such as allotropic transformations, precipitation, martensite formation, solidification, ordering, and corrosion.

ENMA 669 Special Topics in the Chemical Physics of Materials (3)
Prerequisite: permission of both department and instructor.

ENMA 671 Dislocations in Crystalline Materials (3)
Prerequisite: ENMA 650. The nature and interactions of defects in crystalline solids, with primary emphasis on dislocations. The elastic and electric fields associated with dislocations. Effects of imperfections on mechanical and physical properties.

ENMA 672 Mechanical Properties of Engineering Materials (3)
Prerequisite: ENMA 671. The mechanical properties of single crystals, polycrystalline and polyphase materials. Yield strength, work hardening, fracture, fatigue and creep are considered in terms of fundamental material properties.

ENMA 679 Special Topics in the Mechanical Behavior of Materials (3)
Prerequisite: permission of both department and instructor.

ENMA 680 Experimental Methods in Materials Science (3)
Methods of measuring the structural aspects of materials. Optical and electron microscopy. Microscopic analytical techniques. Resonance methods. Electrical, optical and magnetic measurement techniques. Thermodynamic methods.

ENMA 681 Diffraction Techniques in Materials Science (3)
Prerequisite: ENCH 620. Theory of diffraction of electrons, neutrons and X-rays. Strong emphasis on diffraction methods as applied to the study of defects in solids. Short range order, thermal vibrations, stacking faults, microstrain.

ENMA 689 Special Topics in Experimental Techniques in Materials Science (3)
Prerequisite: permission of both department and instructor.

ENMA 691 Special Topics in Engineering Materials (3)
Prerequisite: permission of both department and instructor.

ENMA 697 Seminar in Engineering Materials (1)

ENMA 698 Special Problems in Engineering Materials (1-16)

ENMA 799 Master's Thesis Research (1-6)

ENMA 899 Doctoral Dissertation Research (1-8)

ENME – Engineering, Mechanical

ENME 400 Machine Design (3)
Prerequisites: ENME 310; and ENME 360. Corequisite: ENME 401. Working stresses, stress concentration, stress analysis and repeated loadings. Design of machine elements. Kinematics of mechanisms.

ENME 401 The Structure and Properties of Engineering Materials (3)
Corequisite: ENME 310. The nature and properties of engineering materials as related to their use in all phases of mechanical engineering will be studied. Materials covered include metals, ceramics and glasses, polymer and composites.

ENME 403 Automatic Controls (3)
Prerequisites: ENEE 300; and ENME 360. Senior standing. Hydraulic, electrical, mechanical and pneumatic automatic control systems. Open and closed loops. Steady state and transient operation, stability criteria, linear and non-linear systems. Laplace transforms.

ENME 404 Mechanical Engineering Systems Design (4)
Two hours of lecture and six hours of laboratory per week. *Prerequisites: ENME 400 or ENME 405; and senior standing in mechanical engineering.* Design of components that form a complete working system. Engineering economics, performance-cost studies, optimization. Engineering design practice through case studies. Legal and ethical responsibility of the designer.

ENME 405 Energy Conversion Design (3)
Prerequisite: senior standing in mechanical engineering. Application of thermodynamics, fluid mechanics and heat transfer to energy conversion processes. Design of engines, compressors, heat exchangers. Energy storage and fuel handling equipment.

ENME 408 Selected Topics in Engineering Design (3)
Prerequisite: senior standing in mechanical engineering or permission of department. Repeatable to 6 credits if content differs. Creativity and innovation in design. Generalized performance analysis, reliability and optimization as applied to the design of components and engineering systems. Use of computers in design of multivariable systems.

ENME 410 Operations Research I (3)
Prerequisite: senior standing in mechanical engineering. Applications of linear programming, queuing model, theory of games and competitive models to engineering problems.

ENME 411 Introduction to Industrial Engineering (3)
Prerequisites: [ENME 300; and ECON 205] or permission of department. Design, improvement and installation of integrated systems of men, materials and equipment. Areas covered include industrial activities, plant layout and design, value analysis, engineering economics, quality and production control, methods engineering, industrial relations, etc.

ENME 412 Mechanical Design For Manufacturing and Production (3)
Prerequisite: senior standing in engineering. The physical properties of materials. Review of key fundamental principles used in product design. Characterization of various classes of engineering materials. The types of manufacturing processes which can be applied to production of the design.

ENME 414 Computer-Aided Design (3)
Prerequisites: ENME 205; and MATH 241 or equivalent. Introduction to computer graphics. Plotting and drawing with computer software. Principles of writing interactive software. The applications of computer graphics in computer-aided design. Computer-aided design project.

ENME 415 Engineering Applications of Solar Energy (3)
Prerequisites: ENME 315; and ENME 321. Collection, storage, and utilization of solar thermal energy. Conversion to electricity. Component and system modeling equations. Performance analysis. Systems design.

ENME 422 Energy Conversion II (3)
Prerequisite: ENME 315. Advanced topics in energy conversion. Direct conversion processes of fuel cells, solar cells, thermionics, thermoelectrics and magnetohydrodynamics.

ENME 423 Environmental Engineering (3)
Prerequisites: ENME 321 and senior standing in mechanical engineering. Heating and cooling load computations. Thermodynamics of refrigeration. Low temperature refrigeration. Problems involving extremes of temperature, pressure, acceleration and radiation.

ENME 424 Thermodynamics II (3)
Prerequisites: ENME 321 and senior standing. Applications to special systems, change of phase, low temperature. Statistical concepts, equilibrium, heterogenous systems.

ENME 425 Internal Combustion Engines (3)
Prerequisites: ENME 315; and ENME 321. Fundamentals underlying the design and operation of internal combustion engines. Aspects of fuels, lubricants, instrumentation, combustion and performance. The causes and control of air pollution.

ENME 442 Fluid Mechanics II (3)
Prerequisites: ENME 342 and senior standing. Hydrodynamics with engineering applications. Stream function and velocity potential, conformal transformations, pressure distributions, circulation, numerical methods and analogies.

ENME 450 Mechanical Engineering Analysis For the Oceanic Environment (3)
Characteristics of the marine environment which affect the design, operation and maintenance of mechanical equipment, effects of waves, currents, pressure, temperature, corrosion, and fouling. Study of design parameters for existing and proposed mechanical systems used in marine construction, on shipboard, in search and salvage operations.

ENME 451 Mechanical Engineering Systems For Underwater Operations (3)
Propulsion, control and environmental systems for submerged vehicles. Design of mechanical systems in support of diving and saturated living operations.

ENME 461 Dynamics II (3)
Prerequisites: ENME 360; and differential equations; and senior standing in mechanical engineering. Linear and non-linear plane and three-dimensional motion, moving axes, LaGrange's equation, Hamilton's principle, non-linear vibration, gyroscope, celestial mechanics.

ENME 462 Introduction to Engineering Acoustics (3)
Prerequisite: MATH 246. Study of the physical behavior of sound waves. Introduction to terminology and instrumentation used in acoustics. Criteria for noise and vibration control. Some fundamentals underlying noise control and applications to ventilation systems,machine and shop quieting, office buildings, jet noise, transportation systems and underwater sound.

ENME 463 Mechanical Engineering Analysis (3)
Prerequisite: MATH 246. Mathematical modeling of physical situations. Solution of problems expressed by partial differential equations. Application of Fourier series and integrals. Laplace transformation, Bessel functions, Legendre polynomials and complex problems in mechanical vibrations, heat transfer, fluid mechanics and automatic control theory.

ENME 464 Machine Design II (3)
Prerequisite: ENME 400. The study of stress and strain as applied to engineering problems; stress and strain from a three dimensional point of view; theories of failure; residual stresses; dynamic loading; fatigue; environmental influence; temperature extremes; corrosive media. Case studies of design practices.

ENME 465 Introductory Fracture Mechanics (3)
Senior standing in engineering. An examination of the concepts of fracture in members with preexisting flaws. Emphasis is primarily on the mechanics aspects with the development of the Griffith theory and the introduction of the stress intensity factor, K, associated with different types of cracks. Fracture phenomena are introduced together with critical values of the fracture toughness of materials. Testing procedures for characterizing materials together with applications of fracture mechanics to design.

ENME 470 Finite Element Analysis (3)
Prerequisites: ENME 310; and ENME 321. Basic concepts of the theory of the finite element method. Applications in solid mechanics and heat transfer.

ENME 473 Mechanical Design of Electronic Systems (3)
Prerequisites: ENME 310; and ENME 360; and ENME 321. Design considerations in the packaging of electronic systems. Production of circuit boards and design of electronic assemblies. Vibration, shock, fatigue and thermal considerations.

ENME 475 Robotics (3)
Prerequisites: ENME 360; and ENEE 300. Basic engineering principles in the design and analysis of robots. Industrial applications of robots.

ENME 480 Engineering Experimentation (3)
One hour of lecture and five hours of laboratory per week. *Senior standing in mechanical engineering.* Theory of experimentation. Applications of the principles of measurement and instrumentation systems to laboratory experimentation. Experiments in fluid mechanics, solid mechanics and energy conversion. Selected experiments or assigned projects to emphasize planned procedure, analysis and communication of results, analogous systems and leadership.

ENME 481 Engineering Experimentation (3)
One hour of lecture and four hours of laboratory per week. *Senior standing in mechanical engineering.* Theory of experimentation. Applications of the principles of measurement and instrumentation systems to laboratory experimentation. Experiments in fluid mechanics, solid mechanics and energy conversion. Selected experiments or assigned projects to emphasize planned procedure, analysis and communication of results, analogous systems and leadership.

ENME 488 Special Problems (3)
Prerequisite: permission of department. Advanced problems in mechanical engineering with special emphasis on mathematical and experimental methods.

ENME 489 Special Topics in Mechanical Engineering (3)
Prerequisite: permission of department. Repeatable to 6 credits with permission of advisor. Selected topics of current importance in mechanical engineering.

ENME 600 Design with Advanced Technology (3)
Prerequisite: undergraduate course in machine design. Introduction to the design of electromechanical components. The traditional mechanical elements of design (e.g., gears, V-belts, bearings, etc.), with emphasis on application of fundamental mechanical engineering principles to proper selection. Use of manufacturers' catalogs to demonstrate mechanical component selection methodology. The integration of microprocessor technology and software engineering. Development of smart product design methodology. The role of patents and standards in the design process.

ENME 601 Embedded Microprocessor Design (3)
An introduction to the elements of microprocessor technology and software engineering as used in design. Microcontroller organization and the use of development systems to readily implement intelligent task management in electromechanical systems. Completion of a design project which emphasizes a balance between hardware and software design practice. Emphasis on the sensing, decision support and controlling of mechanical elements for design and manufacturing tools and devices.

ENME 602 Computer-Aided Design (3)
An introduction to software engineering, database formation, and database management. Emphasis on the application of computer techniques to aid the designer in synthesizing and analyzing mechanical systems.

ENME 605 Advanced Systems Control (3)
Prerequisite: an undergraduate course in control systems theory. The fundamentals of control theory using a computer. Generation of a program for functional or process control in a manufacturing environment.

ENME 607 Systems Integration and Simulation (3)
Prerequisite: ENME 605. Modeling simulation and the ability to interface functions and processes. Use of incompatible information. Methods of validation.

ENME 610 Systems Optimization (3)
An introduction to the practical aspects of optimization with a major focus on the techniques relevant to engineering applications arising in design and manufacturing. A broad survey of important optimization methods, ranging from those applicable to a single-variable function to those most suitable for large-scale constrained problems. Formulation of engineering problems. Development and evaluation of the optimal solution.

ENME 611 Manufacturing Processes (3)
A survey of all manufacturing processes with an emphasis on understanding what happens in the process, identification of the capabilities of the process, and demonstrations of specific processes. Hands-on experience for students in a variety of selected processes. Process experience in computer-aided machining applications. Completion of a semester project to investigate, in detail, how a specific consumer item of the student's choice is produced (from a raw material to finished product), with a class presentation and written report.

ENME 612 Mechanical Packaging of Advanced Electronic Systems (3)
The design and manufacturing of chip carriers and circuit boards for electronic systems which incorporate LSI and VLSI semi-conductor devices. The development of advanced electronic systems involves mechanical packaging at three different levels and the incorporation of several million circuits into a cabinet provided with cooling, power supplies, power distribution, signal distribution and I/O busses. Information on design and manufacturing processes covered in the

course provides the student with background important in the development of new electronic products.

ENME 614 Advanced Production Control Techniques (3)
An introduction to the broad area of computer integrated manufacturing and design in modern production plants. The new concepts of computer-aided production control which will be fully developed and analyzed in the rest of the courses of this cycle. Visits to local industries and video tape programs in conjunction with our own laboratory facilities. Individual student projects on specific topics of production management and control.

ENME 615 Manufacturing Resource Planning Systems (3)
A description, analysis and application of the principles of integrated manufacturing systems in modern manufacturing establishments. The architectural and functional requirements of such a system within an operating environment. The activities of and interactions among all of the company's production-related departments. Design of a universal data base to satisfy most of the business needs.

ENME 622 Energy Conversion: Solid-State (3)
Prerequisite: ENME 405. Theory, design and performance analysis of fuel cells, photovoltaic cells, and thermoelectric conversion, considering their compatible energy sources.

ENME 624 Energy Conversion: Plasma State (3)
Prerequisite: ENME 405. Theory, design and performance analysis of magnetoplasmadynamic (magnetohydrodynamic) and thermionic-plasma energy conversion, considering their compatible energy sources. Certain aspects of fusion plasma and fusion energy to electrical energy conversion.

ENME 631 Advanced Conduction and Radiation Heat Transfer (3)
Prerequisites: ENME 315; and ENME 321; and ENME 700. Theory of conduction and radiation. Anisotropic conduction and bidirectional radiation properties and experiments. General conduction and radiation governing equations. Integration, finite-difference, and finite element techniques. Combined conduction and radiation. Engineering applications.

ENME 632 Advanced Convection Heat Transfer (3)
Prerequisites: ENME 315; and ENME 342; and ENME 343; and ENME 700. Theory of convection and mass transfer in pipe flow, boundary layer flow, separated flow, free convection, boiling and condensing. Flow and energy equations. Solutions and engineering applications. Experimental methods.

ENME 633 Advanced Classical Thermodynamics (3)
Prerequisite: ENME 315. The laws of classical thermodynamics. Equations of state. Temperature scales. Availability. General equilibrium. Corollaries to the second law. Chemical thermodynamics.

ENME 634 Statistical and Irreversible Thermodynamics (3)
Prerequisite: ENME 315. Kinetic theory of gases and transport properties. Quantum mechanics and statistics. Partition functions and applications. Solids, liquids, and gases. Irreversible processes, coupled phenomena and applications.

ENME 635 Analysis of Energy Systems (3)
Prerequisites: ENME 403; and ENME 404; and ENME 405. Energy conversion systems for renewable and non-renewable energy sources. Component modeling. Performance charts. Overall indices of performance. Environmental effects. Cost effectiveness. Optimization strategies. Case studies.

ENME 647 Multiphase Flow and Heat Transfer (3)
Prerequisites: ENME 321; and ENME 342 or equivalent. Phase-change heat transfer phenomenology, analysis and correlations; boiling and condensation in stationary systems. Multiphase

flow fundamentals; one-dimensional, two-phase flow analysis. Critical flow rates. Convective boiling and condensation. Two-phase flow instabilities. Applications.

ENME 648 Advanced Topics in Thermal Sciences (3)
Repeatable to 6 credits. Advanced research topics of current interest in Thermal Sciences.

ENME 650 Design of Turbomachinery (3)
Prerequisite: ENME 342 or equivalent. Characteristics and design of turbines, pumps, compressors and torque convertors, cavitation, stall and surge.

ENME 651 Fundamentals of Fluid Mechanics I (3)
Pre- or corequisite: ENME 700 or equivalent mathematical background. A broad study of the fundamental principles of fluid mechanics including potential flow, viscous flow and compressible flow.

ENME 652 Fundamentals of Fluid Mechanics II (3)
Prerequisite: ENME 651. A continuation of ENME 651.

ENME 653 Topics in Hydrodynamics (3)
Prerequisite: ENME 651 or equivalent. Analysis of the flow of fluids in which viscosity and compressibility are not significant. Complex variable techniques, method of images, small perturbation techniques, surface waves, thin airfoil theory, and geophysical flows.

ENME 654 Topics in Compressible Flow (3)
Prerequisite: ENME 652 or equivalent. Study of the compressible flow of fluids. Method of characteristics, experimental techniques, small perturbation theory and similarity rules, and gasdynamics of two-phase flows and reacting mixtures.

ENME 655 Topics in Viscous Flow (3)
Prerequisite: ENME 652 or equivalent. Current techniques in analysing viscous flows in engineering applications. Integral, and numerical methods, asymptotic methods, and their applications.

ENME 658 Current Topics in Fluid Dynamics (3)
May be repeated for credit to maximum of six credits for the M.S. Degree or twelve credits for the Ph.D. Degree.

ENME 662 Linear Vibrations (3)
First semester. Fourier and statistical analysis, transient, steady-state, and random behavior of linear lumped mass systems. Normal mode theory; shock spectrum concepts; mechanical impedance and mobility methods. Vibrations of continuous media including rods, beams, and membranes.

ENME 664 Dynamics (3)
Fundamentals of Newtonian dynamics which includes kinematics of a particle, dynamics of a particle and system of particles, Lagranges equations, basic concepts and kinematics of rigid body motion, dynamics of rigid bodies, Hamilton's principle. Applications to mechanical engineering problems.

ENME 665 Advanced Topics in Vibrations (3)
Prerequisite: ENME 662. Geometrical and numerical analysis of nonlinear and damped vibration systems. Vibration under combined loading of bending, shear and torsion. Random vibrations.

ENME 670 Continuum Mechanics (3)
First semester. The algebra and calculus of tensors in Riemannian space are developed with special emphasis on those aspects which are most relevant to mechanics. The geometry of curves and surfaces in E-3 is examined. The concepts are applied to the derivation of the field equations for the non-linear theory of continuous media and to various problems arising in classical dynamics.

ENME 671 Linear Theory of Elasticity (3)
Second semester. The basic equations of the linear theory are developed as a special case of the non-linear theory. The first and second boundary value problems are discussed together with the problem of uniqueness. Solutions are constructed to problems of technical interest through semi-inverse, transform and potential methods. Included are the study of plane problems, torsion, dynamic response of spherical shells and tubes, microstructure and anisotropic materials.

ENME 677 Applied Elasticity (3)
Prerequisite: MATH 462 or equivalent. Analysis of stress and strain, equilibrium and compatibility conditions, plane stress and plane strain problems, torsion and flexure of bars, general three-dimensional analysis, energy methods, thermal stresses, and wave propagation.

ENME 678 Fracture Mechanics (3)
An advanced treatment of fracture mechanics covering in detail the analysis concepts for determining the stress intensity factors for various types of cracks. Advanced experimental methods for evaluation of materials or structures for fracture toughness. Analysis of moving cracks and the statistical analysis of fracture strength. Finally, illustrative fracture control plans are treated to show the engineering applications of fracture mechanics.

ENME 680 Experimental Mechanics (3)
Prerequisite: undergraduate course in instrumentation or equivalent. Advanced methods of measurement in solid and fluid mechanics. Scientific photography, moire, photoelasticity, strain gages, interferometry, holography, speckle, ndt techniques, shock and vibration, and laser anemometry.

ENME 681 Engineering Acoustics (3)
Analogies in electrical, mechanical, and acoustical systems. Mathematical treatment of electro-mechano-acoustical systems such as speakers, horns and microphones. Wave equation and its solution to phenomena involving the propagation, refraction and transmission of sound. Acoustical measurements and interpretation of results towards noise control. Propagation of spherical waves and the radiation of sound. Architectural acoustics.

ENME 682 Nonlinear Solids (3)
Prerequisite: ENME 700. A survey course dealing with first principals non-linear mechanics. An overview of the classical rheological relations. Theory of creep deformation, viscoelastic deformation and plastic deformation. Emphasis on the more elementary aspects of each topic. Applications to simple engineering problems.

ENME 683 Plates and Shells (3)
Prerequisite: ENME 677 or an equivalent course in elasticity. Theory of surfaces; fundamental equations of thin elastic shells and the specialization of these to the case of flat plates. Problems solved involving orthotropic plates and shells. Shells of revolution under arbitrary loading. Computer usage for the solution of shell and plate problems.

ENME 700 Advanced Mechanical Engineering Analysis I (3)
An advanced, unified approach to the solution of mechanical engineering problems, emphasis is on the formulation and solution of equilibrium, eigenvalue and propagation problems. Review and extension of undergraduate material in applied mathematics with emphasis on problems in heat transfer, vibrations, fluid flow and stress analysis which may be formulated and solved by classical procedures.

ENME 701 Advanced Mechanical Engineering Analysis II (3)
Formulation and solution of mechanical engineering problems. Analysis of oscillatory and non-oscillatory systems utilizing discrete parameter techniques including matrix methods, finite element methods, finite differences and numerical integration. Study of non-linear vibration and control systems with emphasis on perturbation theory and stability analysis. Engineering applications of statistical analysis.

ENME 703 Mechanical Engineering Laboratory (3)
Five hours of laboratory per week. *Prerequisite: an undergraduate course in instrumentation or equivalent.* Theory of measurements, and art and science of using instruments. Instrumentation for measuring fluid flow, temperature and heat, stress and strain, and sound and vibrations. Introduction to non-destructive testing, optical techniques and electronic data processing. Design, conduction and analysis of an experiment.

ENME 760 Advanced Structural Dynamics I (3)
Prerequisite: ENME 602 or equivalent. Advanced topics in structural dynamics analysis: dynamic properties of materials, impact and contact phenomena, wave propagation, modern numerical methods for complex structural systems, analysis for wind and blast loads, penetration loads, and earthquake, non-linear systems, random vibrations and structural failure from random loads.

ENME 788 Seminar (1-3)
Prerequisite: graduate standing in mechanical engineering. First or second semester. Credit in accordance with work outlined by mechanical engineering staff.

ENME 799 Master's Thesis Research (1-6)

ENME 808 Advanced Topics in Mechanical Engineering (2-3)

ENME 899 Doctoral Dissertation Research (1-8)

ENNU – Engineering, Nuclear

ENNU 430 Radioisotope Power Sources (3)
Prerequisite: ENNU 215 or permission of both department and instructor. Principles and theory of radioisotope power sources. Design and use of nuclear batteries and small energy conversion devices.

ENNU 435 Activation Analysis (3)
Prerequisite: ENNU 215 or permission of both department and instructor. Principles and techniques of activation analysis involving neutrons, photons and charged particles. Emphasis placed upon application of this analytical technique to solving environmental and engineering problems.

ENNU 440 Nuclear Technology Laboratory (3)
One hour of lecture and four hours of laboratory per week. *Prerequisites: MATH 240; and PHYS 263.* Techniques of detecting and making measurements of nuclear or high energy radiation. Radiation safety experiments. Both a sub-critical reactor and the swimming pool critical reactor are sources of radiation.

ENNU 450 Nuclear Reactor Engineering I (3)
Prerequisites: [MATH 246; and PHYS 263] or permission of both department and instructor. Elementary nuclear physics, reactor theory, and reactor energy transfer. Steady-state and time-dependent neutron distributions in space and energy. Conduction and convective heat transfer in nuclear reactor systems.

ENNU 455 Nuclear Reactor Engineering II (3)
Prerequisite: ENNU 450. General plant design considerations including radiation hazards and health physics, shielding design, nuclear power economics, radiation effects on reactor materials, and various types of nuclear reactor systems.

ENNU 460 Nuclear Heat Transport (3)
Prerequisite: ENNU 450. Heat generation in nuclear reactor cores, conduction and transfer to coolants. Neutron flux distributions, fission and heat release. Steady and unsteady state conduction in fuel elements. Heat transfer to nonmetallic and metallic coolants. Heat transfer with phase change. Thermal design of reactor cores.

ENNU 461 Chemical Separation in the Nuclear Cycle Reactor Fuel (3)
Prerequisite: ENNU 450 or permission of both department and instructor. An introduction to chemical and physical separation of the nuclear reactor fuel. Basic separation processes, reactor

fuel fabrication, reactor chemistry problems and the handling and treatment of radioactive waste. Calculations of plant design and operation. Related safety issues.

ENNU 465 Nuclear Reactor Systems Analysis (3)

Prerequisites: [MATH 246; and PHYS 263; and ENNU 455] or permission of department. Power reactor (BWR,PWR,HTGR) system design and analysis. System specifications and modes of operation. Plant documentation (PSAR,FSAR, etc.). Piping and instrumentation drawings. Theory and application of pump and piping calculations. Steam power plant cycles and calculations. Steam plant equipment (turbines, heaters, condensers, etc.) analysis.

ENNU 468 Research (2-3)

Prerequisite: permission of both department and instructor. Repeatable to 6 credits. Investigation of a research project under the direction of one of the staff members. Comprehensive reports are required.

ENNU 470 Introduction to Controlled Fusion (3)

Prerequisite: senior standing in engineering or permission of both department and instructor. The principles and the current status of research to achieve controlled thermonuclear power production. Properties of ionized gases relating to confinement and heating. Concepts of practical fusion devices.

ENNU 480 Reactor Core Design(3)

Prerequisite: ENNU 450 or permission of both department and instructor. Design of nuclear reactor cores based on a sequence of standard computer codes. Thermal and epithermal cross sections, multigroup diffusion theory in one and two dimensions and fine structure flux calculations using transport theory.

ENNU 490 Nuclear Fuel and Power Management (3)

Prerequisites: [ENNU 460; and ENNU 480] or permission of both department and instructor. Physics and economics of the nuclear fuel cycle utilizing existing design codes. Mining, conversion, enrichment, fabrication, reprocessing processes. Effects of plutonium recycle, in-core shuffling, fuel mechanical design and power peaking on fuel cycle costs.

ENNU 609 Seminar in Nuclear Engineering (1)

ENNU 620 Methods of Engineering Analysis (3)

Application of selected mathematical techniques to the analysis and solution of engineering problems; included are the applications of matrices, vectors, tensors, differential equations, integral transforms, and probability methods to such problems as unsteady heat transfer, transient phenomena in mass transfer operations, stagewise processes, chemical reactors, process control, and nuclear reactor physics.

ENNU 630 Nuclear Reactor Physics I (3)

Prerequisite: ENNU 450 or permission of both department and instructor. Introduction to neutron physics. Elements of neutron slowing-down theory. The Boltzman transport equation is developed together with approximations such as PN, SN, and Fermi Age. Nuclear systems are theoretically treated utilizing the diffusion approximation, the Fermi Age method and the P-3 method. Elementary temperature and time dependence.

ENNU 640 Nuclear Reactor Physics II (3)

Prerequisite: ENCH 320. Second semester. Mathematical treatment of nuclear reactor systems. The foundations of nuclear reactor kinetics, the multigroup treatment, reflected reactor theory, heterogeneous reactors, perturbation theory. Thermalization theory and the pulse and sine-wave techniques. Introduction to variational methods.

ENNU 648 Special Problems in Nuclear Engineering (1-16)

ENNU 649 Selected Topics in Nuclear Engineering (3-12)

Prerequisite: permission of instructor. Repeatable to 12 credits if content differs. Topics of current interest and recent advances in the nuclear engineering field. Because of the rapid advances in

the field, information on special topics of much practical importance is continually becoming available.

ENNU 655 Radiation Engineering (3)
Prerequisite: permission of both department and instructor. An analysis of such radiation applications as synthesizing chemicals, preserving foods, control of industrial processes, design of irradiation installations. E.G., Cobalt 60 gamma ray sources, electronuclear machine arrangement, and chemonuclear reactors.

ENNU 671 Nuclear Reactor Laboratory (3)
One hour of lecture and four hours of laboratory per week. *Prerequisite: permission of both department and instructor.* The University of Maryland swimming pool reactor is employed in experiments on reactor start-up and operation, shielding, control, neutron flux distributions, neutron and gamma spectrum, cross-section measurements.

ENNU 720 Neutral Particle Transport Theory (3)
Prerequisite: ENNU 630 or permission of both department and instructor. First semester. Transport equations for neutrons and gamma rays. Infinite space and milne problems. Spherical harmonic and variational methods. Special methods of solving transport equations.

ENNU 730 Radiation Shielding and Energy Deposition (3)
Prerequisite: ENNU 630 or permission of both department and instructor. A study of the interactions of nuclear radiations with matter. Includes electron, gamma and neutron attenuation, dose calculations, chemical changes, heat generation and removal in shields. Fall semester.

ENNU 761 Nuclear Fuel and Waste Processing (3)
First semester. Processing of nuclear fuel and treatment of nuclear waste. Includes: processing of uranium, thorium, and other ores; chemical separation of plutonium, uranium, fission products and other elements from materials irradiated in nuclear reactors; treatment of radioactive wastes; isotopic separation of U235; and isotopic separation of heavy water and other materials.

ENNU 799 Master's Thesis Research (1-6)

ENNU 840 Nuclear Reactor Design (3)
Prerequisite: ENNU 630 or permission of both department and instructor. The design features of nuclear reactor systems. The preliminary design of a reactor is carried out by the student. Core design including heat transfer, control system, safety systems and shielding. Standard computer programs are utilized throughout.

ENNU 860 Fast Reactor Engineering (3)
Prerequisite: ENNU 630. Engineering and physics problems of fast reactors. Neutron economy and breeding. Transport theory based on neutronic core design. Liquid metal and gaseous coolant heat transfer. Aspects of fast reactor plant design.

ENNU 899 Doctoral Dissertation Research (1-8)

ENTM – Entomology

ENTM 407 Entomology For Science Teachers (4)
Four lectures and four three-hour laboratory per week. Summer. This course will include the elements of morphology, taxonomy and biology of insects using examples commonly available to high school teachers. It will include practice in collecting, preserving, rearing and experimenting with insects insofar as time will permit.

ENTM 423 Insect Comparative Morphology (4)
Two hours of lecture and six hours of laboratory per week. *Prerequisite: ENTM 205.* Morphology and anatomy of insects. Comparison of structures using specimens from common orders to study the phylogenetic relationships and to form a basis for understanding insect classification systems.

ENTM 424 Insect Diversity and Classification (4)
One hour of lecture and six hours of laboratory per week. *Prerequisites: ENTM 205; and ENTM 423.* The techniques of collecting insects in the field and their classification into the latest hierarchical scheme. Field trips will visit habitats throughout the state. An insect collection is required.

ENTM 432 Insect Physiology (4)
Three hours of lecture and three hours of laboratory per week. *Prerequisite: ENTM 205; and CHEM 233; and CHEM 243; or permission of department.* The physiology of different insect systems. Hormonal basis of insect metamorphosis and reproduction.

ENTM 451 Insect Pests of Agricultual Crops (4)
Two hours of lecture and four hours of laboratory per week. *Prerequisite: ENTM 205.* The recognition, biology and control of insects injurious to fruit and vegetable crops, field crops and stored products.

ENTM 452 Insecticides (2)
Prerequisite: permission of department. The development and use of contact and stomach poisons, fumigants and other important chemicals, with reference to their chemistry, toxic action, compatability, and host injury. Recent research emphasized.

ENTM 453 Insect Pests of Ornamentals and Turf (3)
Two hours of lecture and three hours of laboratory per week. *Prerequisite: ENTM 205 or permission of department.* The recognition, biology and control of insects and mites injurious to ornamental shrubs, trees, greenhouse crops, and turf. Emphasis on pests of woody ornamental plants.

ENTM 454 Principles of Plant Protection (2)
One hour of lecture and two hours of laboratory per week. *Prerequisites: ENTM 205 and permission of department.* Systematic assessment of the principles of plant protection and pest population management.

ENTM 455 Urban Entomology (3)
Two hours of lecture and three hours of laboratory per week. *Prerequisite: ENTM 421 or permission of department.* A study of the appearance, habits, life cycles and methods of control of pests of humans, pets and structures in the urban environment. Field observations of professional pest control operations and a paper on a selected pest group are required.

ENTM 472 Medical and Veterinary Entomology (4)
Three hours of lecture and two hours of laboratory per week. *Prerequisite: ENTM 205 or permission of department.* A study of the morphology, taxonomy, biology and control of the arthropod parasites and disease vectors of man and animals. The ecology and behavior of vectors in relation to disease transmission will be emphasized.

ENTM 611 Biological Suppression of Plant Pests (3)
Prerequisite: permission of department. An advanced course on the theory and practice of biological control with an emphasis on biological insect pest suppression. The biological control of weeds and plant pathogens with emphasis on the ecological and behavioral foundations of biological control.

ENTM 612 Insect Ecology (3)
Prerequisite: a course in general ecology or permission of department. An advanced course in population and community ecology, plant-insect interactions, and insect biogeography. Emphasis on current entomological literature.

ENTM 622 Principles of Systematic Entomology (3)
Two hours of lecture and three hours of laboratory per week. *Prerequisite: ENTM 421.* The principles of systematics including traditional classification methods, cladistics, and numerical

taxonomy. Nomenclature, continental drift, and speciation theory. A laboratory problem in systematics is required.

ENTM 623 Insect Evolutionary Biology (3)
Prerequisite: ENTM 423 or permission of department. The relevance of evolutionary biology to ecology, comparative physiology/morphology, and pest management. Phylogeny and paleontology of insect orders; insect biogeography; coevolution and evolutionary ecology; insect speciation mechanisms; population genetics of insects, with emphasis on implications for pest management.

ENTM 652 Laboratory Methods in Toxicology (1-2)
One hour of lecture and three hours of laboratory per week. *Pre- or corequisite: ENTM 653 or MEES 641 or permission of department.* A methodology and techniques course designed to give the student experience in toxicological research. The first half of the course may be taken for one credit and will emphasize methods useful to entomologists.

ENTM 653 Toxicology of Insecticides (3)
A study of the physical, chemical, biological and toxicological properties of insecticides. Emphasis on the relationship of chemical structure to insecticidal activity and mode of action. Insect resistance mechanisms.

ENTM 654 Advanced Pest Management (3)
Two hours of lecture and two hours of laboratory per week. *Prerequisite: ENTM 454 or equivalent.* Pest management with emphasis on an interdisciplinary, holistic approach. Integration of pest management tactics and the development of strategies particularly as they pertain to plant protection from pests. Management systems, application of ecological, economic, and genetic concepts to pest management, and the interaction of pest management with society.

ENTM 662 Insect Pathology (3)
Three lectures with directed independent laboratory study. *Prerequisite: MICB 200. Pre- or corequisite: ENTM 641 or permission of department.* An examination of primarily insect pathogens with special reference to symptomology, epizootiology and mode of action, and the microbial control of insect pests.

ENTM 699 Advanced Entomology (1-6)
Credit and prerequisites to be determined by the department. First and second semesters. Studies of minor problems in morphology, physiology, taxonomy and applied entomology, with particular reference to the preparation of the student for individual research.

ENTM 723 Taxonomy of Larval Insects (2)
One hour of lecture and two hours of laboratory per week. *Prerequisite: ENTM 421 or permission of department.* Taxonomy of larval insects. A study of the identification and biology of larval insects. A collection is required.

ENTM 728 Advanced Systematics of Selected Orders (1-3)
Prerequisite: permission of department. Advanced systematics of selected orders. One lecture or one three-hour laboratory a week for each credit hour. Lectures and laboratory sessions on the systematics of selected major insect orders such as coleoptera, lepidoptera, diptera, and hymenoptera, or groups of minor orders.

ENTM 788 Entomological Topics (1-3)
Prerequisite: permission of department. One lecture or one two-hour laboratory period a week for each credit hour. Lectures, group discussions or laboratory sessions on selected topics such as: aquatic insects, biological control of insects, entomological literature, forest entomology, history of entomology, insect biochemistry, insect embryology, immature insects, insect behavior, insect communication, principles of entomological research.

ENTM 789 Field Experience in Pest Management (1-6)
Prerequisite: ENTM 654 or permission of department. Repeatable to 6 credits. Involvement in practical problems of pest management in field situations. The student will be assigned to a

problem area for intensive experience, usually during the summer. A final written report is required for each assignment.

ENTM 798 Topic Seminar (1)
Discussion and presentation of current research and literature.

ENTM 799 Master's Thesis Research (1-6)

ENTM 899 Doctoral Dissertation Research (1-8)

FDSC – Food Science

FDSC 412 Principles of Food Processing I (3)
The principles of thermal processing including heat resistance of bacteria and bacterial spores, concepts of lethality, heat transfer, and thermal process calculations. Advanced systems of thermal processing and packaging including aseptic applications.

FDSC 413 Principles of Food Processing II (3)
A detailed study of food processing with emphasis on line and staff operations, including physical facilities, utilities, pre-and post-processing operations, processing line development and sanitation.

FDSC 421 Food Chemistry (3)
Prerequisite: BCHM 261. The application of basic chemical and physical concepts to the composition and properties of foods. Emphasis on the relationship of processing technology, to the keeping quality, nutritional value, and acceptability of foods.

FDSC 422 Food Product Research and Development (3)
Four hours of laboratory per week. *Prerequisite: FDSC 412; and FDSC 413 or permission of department.* Four all day Saturday trips required. A study of the research and development function for improvement of existing products and development of new, economically feasible and marketable food products. Application of chemical-physical characteristics of ingredients to produce optimum quality products, cost reduction, consumer evaluation, equipment and package development.

FDSC 423 Food Chemistry Laboratory (2)
Four hours of laboratory per week. *Pre- or corequisite: FDSC 421.* Analysis of the major and minor constituents of food using chemical, physical and instrumental methods in concordance with current food industry and regulatory practices. Laboratory exercises coincide with lecture subjects in FDSC 421.

FDSC 430 Food Microbiology (2)
Prerequisite: MICB 200 or equivalent. A study of microorganisms of major importance to the food industry with emphasis on food-borne outbreaks, public health significance, bioprocessing of foods, disease control, and the microbial spoilage of foods.

FDSC 431 Food Quality Control (4)
Three hours of lecture and two hours of laboratory per week. Definition and organization of the quality control function in the food industry; preparation of specifications; statistical methods for acceptance sampling; in-plant and processed product inspection. Instrumental and sensory methods for evaluating sensory quality, identity and wholesomeness and their integration into grades and standards of quality. Statistical Process Control (SPC).

FDSC 434 Food Microbiology Laboratory (2)
Four hours of laboratory per week. *Pre- or corequisite: FDSC 430.* A study of techniques and procedures used in the microbiological examination of foods.

FDSC 442 Horticultural Products Processing (3)
Two hours of lecture and two hours of laboratory per week. Commercial methods of canning, freezing, dehydrating, fermenting, and chemical preservation of fruit and vegetable crops.

FDSC 451 Dairy Products Processing (3)
Two hours of lecture and two hours of laboratory per week. Method of production of fluid milk, butter, cheese, condensed and evaporated milk and milk products and ice cream.

FDSC 461 Technology of Market Eggs and Poultry (3)
Two hours of lecture and two hours of laboratory per week. A study of the technological factors concerned with the processing, storage, and marketing of eggs and poultry and the factors affecting their quality.

FDSC 471 Meat and Meat Processing (3)
Two hours of lecture and two hours of laboratory per week. *Prerequisite: BCHM 261 or permission of department.* Physical and chemical characteristics of meat and meat products, meat processing, methods of testing and product development.

FDSC 482 Seafood Products Processing (3)
Two hours of lecture and two hours of laboratory per week. *Prerequisite: BCHM 261 or permission of department.* The principal preservation methods for commercial seafood products with particular reference to the invertebrates. Chemical and microbiological aspects of processing are emphasized.

FDSC 621 Systems Analysis in the Food Industry (3)
Construction and solution of models for optimizing feed, product formulations, nutrient-palatability costs. Methods for optimizing processes, inventories, and transportation systems.

FDSC 631 Advanced Food Microbiology (2)
Prerequisite: FDSC 430 or permission of instructor. One lecture and one laboratory period a week. An in-depth understanding and working knowledge of a selected number of problem areas and contemporary topics in food microbiology.

FDSC 689 Seminar in Food Science (1-3)
Studies of selected phases of food science.

FDSC 698 Colloquium in Food Science (1)
Oral reports on special topics or recently published research in food science and technology. Distinguished scientists are invited as guest lecturers. A maximum of three credits allowed for the M.S.

FDSC 699 Special Problems in Food Science (1-4)
Prerequisite: CHEM 461 or permission of department. Credit according to time scheduled and magnitude of problem. An experimental program on a topic other than the student's thesis problem will be conducted. Four credits shall be the maximum allowed toward an advanced degree.

FDSC 799 Master's Thesis Research (1-6)

FDSC 811 Advances in Food Technology (3)
Prerequisite: CHEM 461 or permission of instructor. A systematic review of new products, processes and management practices in the food industry.

FDSC 899 Doctoral Dissertation Research (1-8)

FMCD – Family and Community Development

FMCD 430 Gender Role Development in the Family (3)
Prerequisites: SOCY 100; and FMCD 260; or permission of department. The development of historical, cultural, developmental, and psychosocial aspects of masculinity and femininity within the context of contemporary families and the implications for interpersonal relations.

FMCD 431 Family Crises and Intervention (3)
Prerequisite: PSYC 100. Family crises such as divorce, disability, substance abuse, financial problems, intrafamilial abuse, and death. Theories and techniques for intervention and enhancement of family coping strategies.

FMCD 432 Intergenerational Aspects of Family Living (3)
Prerequisites: PSYC 100; and SOCY 100; and [FMCD 332 or other human development course]. The historical, cultural, developmental, and psychosocial experiences of contemporary American generations. Interactions across generations within the family and the consequences for individual development. Cross-national comparisons.

FMCD 441 Personal and Family Finance (3)
Prerequisite: ECON 201; or ECON 205; or permission of department. Study of individual and family financial strategies with particular emphasis upon financial planning, savings, insurance, investments, income taxes, housing, and use of credit.

FMCD 443 Consumer Problems (3)
Prerequisite: ECON 201; or ECON 205; or permission of department. The consumer perspective in the production, marketing, and use of goods and services. Special emphasis on the investigation of current issues.

FMCD 444 Human and Community Program Management (3)
Goals, approaches, settings, and resources relevant to the management of human service programs in the community.

FMCD 445 Family and Household Management (3)
Interrelationship of resources (time, money, energy, space, materials and human resources) in operation of the household and in meeting demands of multiple roles of family members. Management as intervention strategy.

FMCD 447 The Disabled Person in the Family and Community (3)
Prerequisite: PSYC 100 or SOCY 100. Disabled persons in family and community settings. Improvement of the quality of life of disabled persons.

FMCD 453 Family and Community Advocacy (3)
Prerequisites: 6 credits in SOCY and GVPT. Strategies for change used by governmental and non-governmental institutions to improve the quality of family and community life in a variety of political, social and historical contexts.

FMCD 460 Violence in the Family (3)
Prerequisite: PSYC 100 or SOCY 105 or FMCD 487. Theories of child, spousal, parental, grandparental abuse in the family setting, review of current evidence, and an introduction to methods for prevention and remediation.

FMCD 483 Family and Community Service Systems (3)
Prerequisites: 6 credits in SOCY and GVPT. The planning, implementation, administration, and evaluation of human services systems affecting families and communities. Major organizational theories, managerial styles, administrative techniques, and issues in human service delivery.

FMCD 485 Introduction to Family Counseling (3)
Prerequisites: FMCD 431; or PSYC 331; or PSYC 335; or permission of department. The fundamental theoretical concepts and clinical procedures that are unique to marital and family therapy. Individually-oriented psychotherapy. Pre-marital, marital and family, and divorce counseling techniques.

FMCD 487 Legal Aspects of Family Problems (3)
Prerequisite: FMCD 105 or SOCY 105. Laws and legal procedures, with emphasis on adoption, marriage, divorce, annulment, and property rights, and how they affect family life.

FMCD 497 The Child and the Law (3)
Legislation and case law regarding children's legal rights with emphasis on the rights of children in the juvenile justice system, and rights to medical, educational, and other social services.

FMCD 499 Special Topics (1-3)
A - Family Studies B - Community Studies C - Management and Consumer Studies

FMCD 600 Research and Theory in Family Studies (3)
Survey of theories and research in the family. An overview of the theoretical frameworks underlying research on the family, and of the major research and theory in the field.

FMCD 601 Theory and Practice in Community Development (3)
Community development within inter- and intra-national contexts. Inter-disciplinary analysis of the relation between theory and practice.

FMCD 602 Human and Community Management: Theory and Research (3)
Theories of management and their application to the family and community in a variety of social and historical settings.

FMCD 604 Integrative Aspects of Family and Community Development (3)
Multidisciplinary approach to studying and improving the quality of life, drawing upon family, management/consumer, and community studies.

FMCD 609 Seminar in Family and Community Development (1-3)
Repeatable to 4 credits with permission of department. Explorations of current theories, methods, and issues in family and community development. Topics vary with instructor and student interests.

FMCD 610 Research Methods for Family and Community Development (3)
Prerequisite: satisfactory completion of department competency examination in statistics or an approved statistics course. Research methods in the family and community development field. The role of theory, use of qualitative versus quantitative techniques, and differences between objective and subjective measurements. Emphasis on the logic and assumptions of research rather than specific techniques.

FMCD 615 Needs Assessment for Family and Community Development (3)
Exploration and application of needs assessment in family and community programs. A survey of theoretical and empirical literature regarding needs, the quality of life, and social indicators, combined with practical workshop experience.

FMCD 630 Theory and Research in Human Sexuality (3)
Prerequisite: a basic course in human sexuality or permission of instructor. Survey of theory and research in human sexuality and examination of implications for contemporary family and community life.

FMCD 640 Family Therapy: Theory and Techniques (3)
The fundamental theoretical concepts and clinical procedures unique to marital and family therapy, with an emphasis on those therapies which operate from a family systems perspective. Contrast between family therapy and individually-oriented psychotherapy. Analysis of family interaction processes and techniques for facilitating those processes.

FMCD 641 The Dynamics of Couple Therapy (3)
Prerequisite: FMCD 640. The dynamics of the couple relationship and methods of facilitating growth and interaction within that relationship. Emphasis on couples with conflicting needs and expectations, and dysfunctional communication and conflict-negotiation skills. Theories on marital therapy.

FMCD 642 Intergenerational Aspects of Family Therapy (3)
Prerequisite: FMCD 640. The psychological difficulties encountered within the family context which directly impact upon the parent- child relationship. Emphasis on families with school-age children, and developmental (child) psychopathology in a family context, with some attention to adult children and their parents.

FMCD 645 Sexual Issues and the Helping Professional (3)
Prerequisites: a basic course in human sexuality and permission of instructor. Sensitization of students to sexual issues and exploration of how their perceptions of such issues affect their work

with people. Students are required to participate in a sexual attitudes assessment weekend workshop.

FMCD 647 Theory and Techniques of Family Mediation (3)
An introduction to family mediation as an approach to helping families deal effectively with the issues associated with separation and divorce. Theory, practice, and techniques of negotiation, with an emphasis on custody, property division, and the constructive restructuring of family relationships.

FMCD 650 Clinical Seminar in Family Therapy (3)
Prerequisite: permission of instructor. Limited to students admitted to the family therapy practicum. An introduction to the basic principles and practices of family therapy. Emphasis on basic therapy skills applied to a family context and on professional ethics of the helping professional.

FMCD 651 Clinical Practicum in Family Therapy I (3)
Prerequisite: FMCD 650. Limited to students admitted to the family therapy practicum. Clinical casework in family therapy.

FMCD 652 Clinical Practicum in Family Therapy II (3)
Prerequisite: FMCD 651. Limited to students admitted to the family therapy practicum. A continuation of FMCD 651.

FMCD 653 Clinical Practicum in Family Therapy III (3)
Prerequisite: FMCD 652. Limited to students admitted to the family therapy practicum. Advanced clinical casework in family therapy.

FMCD 660 Planning of Family and Community Development Programs (3)
Theory and methods of planning with special emphasis upon family and community development programs.

FMCD 661 Evaluation of Family and Community Development Programs (3)
Theory and methods of evaluation with special emphasis upon family and community development programs.

FMCD 689 Internship in Family and Community Development (3-6)
Prerequisites: permission of instructor and department. Repeatable to 6 credits. Internship related to the student's chosen specialization.

FMCD 691 Family-Community Consultation (3)
The enhancement of family and community services through the consultation process. Techniques and approaches to consultation, including both the role of the consultant and the needs of agencies. Individual field experience.

FMCD 698 Advanced Topics in Family and Community Development (1-3)
Repeatable to 12 credits. Arranged group study on specific topic which may vary from term to term.

FMCD 699 Independent Study (1-6)
Prerequisites: permission of instructor and department. Repeatable to 6 credits.

FMCD 799 Master's Thesis Research (1-6)

FOLA – Foreign Language

FOLA 408 Foreign Language I (3)
Intensive study of a foreign language or related topic not available under one of the current foreign language departments or programs. May not be used to fulfill the arts and humanities language requirement.

FOLA 409 Foreign Language II (3)
Prerequisite: FOLA 408 in the same language or topic. A continuation of FOLA 408. May not be used to fulfill arts and humanities language requirement.

FOLA 459 Foreign Literature in Translation (3)
Repeatable to 6 credits if content differs. Reading and discussion of selected authors, periods or genres of a foreign literature not otherwise offered. All readings and instruction in English.

FOOD – Food

Some of these courses may require the use of animals. See the statement on Animal Care and Use in the appendix and the policy statement for students under degree requirements.

FOOD 440 Advanced Food Science I (3)
Prerequisites: FOOD 250; and BCHM 261 or BCHM 461. Chemical and physical properties of food as related to consumer use in the home and institutions.

FOOD 445 Advanced Food Science Laboratory (1)
Three hours of laboratory per week. *Pre- or corequisite: FOOD 440.* Chemical determination of selected components in animal and plant foods.

FOOD 450 Advanced Food Science II (3)
One hour of lecture and six hours of laboratory per week. *Prerequisite: FOOD 440 or equivalent.* Individual and group laboratory experimentation as an introduction to methods of food research.

FOOD 480 Food Additives (3)
Prerequisite: FOOD 440 or equivalent or permission of department. Effects of intentional and incidental additives on food quality, nutritive value and safety. Current regulatory procedures.

FOOD 490 Special Problems in Foods (2-3)
Prerequisites: FOOD 440 and permission of department. Individual selected problems in the area of food science.

FOOD 498 Selected Topics (1-3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs. Selected current aspects of food.

FOOD 620 Nutritional and Quality Evaluation of Food (3)
Prerequisite: FOOD 440 or permission of department. Effects of production, processing, marketing, storage, and preparation on nutritive value and quality of foods.

FOOD 625 Food Texture (3)
Prerequisite: FOOD 450 or equivalent or permission of department. A study of the factors related to food texture; the classification of food systems according to textural parameters; use of instrumentation in the evaluation of food texture.

FOOD 630 Sensory Evaluation of Foods (3)
Prerequisites: FOOD 450 or equivalent; and a statistics course. A study of the role of sensory analysis in the evaluation of food quality. Principles and methodologies of sensory evaluation with emphasis on planning, conducting, and reporting sensory tests.

FOOD 635 Advances in Food Proteins (3)
Prerequisite: FOOD 440 or equivalent. Current advances in food proteins as related to the consumer; including sources, chemical and physical properties, utilization, and structural modifications. Changes in nutritional and functional properties during processing.

FOOD 640 Food Enzymes (3)
Prerequisite: FOOD 440 or equivalent. Behavior and reaction of enzymes in food systems. Production and immobilization of food enzymes. Application of enzymes to improve the nutritional and functional quality of foods. Effects of enzymes and enzyme products on human health.

FOOD 645 Advances in Food Lipids (3)
Prerequisite: FOOD 440 or equivalent. Current advances in food lipids as related to the consumer, including sources, utilization, and chemical and physical properties. Modification of food lipids to improve nutritional and functional properties.

FOOD 650 Advanced Experimental Food (3-5)
Selected readings of literature in experimental foods. Development of individual problem.

FOOD 660 Research Methods (3)
Prerequisite: a statistics course. A study of appropriate research methodology and theories including experimental design. Each student is required to develop a specimen research proposal.

FOOD 670 Food-Related Behavior of the Individual (3)
Prerequisite: permission of department. Examination of the factors that influence food-related behavior and of the research methods used.

FOOD 675 Current Issues in Food, Nutrition, and Foodservice Administration (3)
Prerequisite: At least 3 credits of graduate-level coursework in FOOD, NUTR, or FSAD. Broad issues related to the present and future quality, quantity and distribution of the U.S. food supply. The integration of efforts to develop policy relative to the U.S. food supply.

FOOD 678 Selected Topics in Foods (1-6)
Repeatable to 6 credits. Individual or group study in an area of foods.

FOOD 688 Seminar (1-2)
Reports and discussions of current research in foods.

FOOD 789 Non-Thesis Research (1-3)
Directed graduate study which forms the basis of a non-thesis research paper.

FOOD 799 Master's Thesis Research (1-6)

FOOD 888 Doctoral Seminar (1)
Prerequisite: permission of department. Discussion of current research related to foods. Presentations by doctoral students, faculty and visiting speakers.

FOOD 899 Doctoral Dissertation Research (1-8)

FREN – French

FREN 400 Applied Linguistics (3)
The nature of applied linguistics and its contribution to the effective teaching of foreign languages. Comparative study of English and French, with emphasis upon points of divergence. Analysis, evaluation and construction of related drills.

FREN 401 Stylistics (3)
Prerequisite: FREN 301 or permission of department. Comparative stylistic analysis; translation.

FREN 402 Advanced Grammar and Phonetics (3)
Prerequisite: FREN 301 or permission of department. Theory and practice of grammatical structures and rules of phonetics.

FREN 404 Advanced Conversation in French (3)
Prerequisite: FREN 311 or FREN 312 or permission of department. Development of fluency in French, stress on correct sentence structure and idiomatic expression.

FREN 405 Explication De Textes (3)
Oral and written analysis of short literary works, or of excerpts from longer works chosen for their historical, structural, or stylistic interest, with the purpose of training the major to understand literature in depth and to make mature esthetic evaluations of it.

FREN 406 Business and Commercial French (3)
A study of French as used in the business and commercial world.

FREN 407 History of the French Language (3)
Evolution of the French language from Latin to modern French.

FREN 419 Studies in Medieval French Literature (3)
Repeatable to 6 credits if content differs. Selected topics in medieval French literature.

FREN 429 Studies in French Literature of the Renaissance (3)
Repeatable to 6 credits if content differs. Selected topics in French literature of the Renaissance.

FREN 439 Studies in 17th Century French Literature (3)
Repeatable to 6 credits if content differs. Selected topics in seventeenth-century French literature.

FREN 449 Studies in 18th Century French Literature (3)
Repeatable to 6 credits if content differs. Selected topics in eighteenth-century French literature.

FREN 459 Studies in 19th Century French Literature (3)
Repeatable to 6 credits if content differs. Selected topics in nineteenth-century French literature.

FREN 469 Studies in 20th Century French Literature (3)
Repeatable to 6 credits if content differs. Selected topics in twentieth-century French literature.

FREN 471 French Civilization I (3)
French life, customs, culture, traditions (800-1750).

FREN 472 French Civilization II (3)
Credit will be granted for only one of the following: FREN 472 or FREN 370. French life, customs, culture, traditions (1750 to the early twentieth century).

FREN 473 Contemporary French Society (3)
The forces shaping contemporary France. Analysis of social groups, economic development, institutions, political structures. Lectures, discussions and most readings in French.

FREN 475 French Cinema: A Cultural Approach (3)
A study of French culture, civilization, and literature through the medium of film.

FREN 478 Themes and Movements of French Literature in Translation (3)
Studies treatments of thematic problems or of literary or historical movements in French literature. Topic to be determined each semester. Given in English.

FREN 479 Masterworks of French Literature in Translation (3)
Treats the works of one or more major French writers. Topic to be determined each semester. Given in English.

FREN 489 Pro-Seminar in Themes or Movements of French Literature (3)
Repeatable to 6 credits if content differs.

FREN 494 Honors Independent Study (3)
Open only to students admitted to the departmental honors program. Honors independent study involves guided readings based on an honors reading list and tested by a 6 hour written examination. HONR 494 and HONR 495 are required to fulfill the departmental honors requirement.

FREN 495 Honors Thesis Research (3)
Open only to students admitted to the departmental honors program. Honors thesis research involves the writing of a paper under the direction of a professor in this department and an oral examination. HONR 494 and HONR 495 are required to fulfill the departmental honors requirement.

FREN 498 Special Topics in French Literature (3)
Repeatable to 6 credits if content differs.

FREN 499 Special Topics in French Studies (3)
Repeatable to 6 credits if content differs. An aspect of French studies, the specific topic to be announced each time the course is offered.

FREN 600 Problems in Bibliography and Research Methods (3)

FREN 601 The History of the French Language (3)

FREN 603 Stylistics (3)
Advanced composition, translation, stylistic analysis.

FREN 609 Special Topic in the French Language (3)

FREN 619 Special Topic in Medieval French Literature (3)

FREN 629 Special Topic in Sixteenth Century French Literature (3)

FREN 631 Moliere (3)

FREN 632 Racine (3)

FREN 639 Special Topic in Seventeenth Century French Literature (3)

FREN 640 Voltaire (3)

FREN 641 Rousseau (3)

FREN 649 Special Topic in Eighteenth Century French Literature (3)

FREN 650 French Poetry in the Nineteenth Century (3)

FREN 653 The French Novel in the Nineteenth Century (3)

FREN 659 Special Topic in Nineteenth Century French Literature (3)

FREN 660 French Poetry in the Twentieth Century (3)

FREN 663 The French Novel in the Twentieth Century (3)

FREN 665 The French Theatre in the Twentieth Century (3)

FREN 669 Special Topics in Twentieth Century French Literature (3)

FREN 679 The History of Ideas in France (3)
Analysis of currents of ideas as reflected in different periods and authors of French literature.

FREN 689 Seminar in a Great Literary Figure (3)

FREN 699 Seminar (3)
Topic to be determined each semester.

FREN 702 Structural French Linguistics (3)
Synchronic description of the phonology, morphology and syntax of modern spoken French: standard French in contrast with other varieties.

FREN 709 College Teaching of French (1)
Repeatable to 2 credits. Introduction to the teaching of French at the college level with particular emphasis on methodology. Seminars in theory, demonstration of different teaching techniques, supervised practice teaching, training in language laboratory procedures, evaluation of instructional materials. Required of all graduate assistants in French.

FREN 798 Master's Independent Study (1-3)
Prerequisite: permission of the department's Director of Graduate Studies. Repeatable to 3 credits.

FREN 799 Master's Thesis Research (1-6)

FREN 818 French Literary Criticism (3)
Analysis and evaluation of various trends in literary criticism. Topic to be determined each semester.

FREN 898 Doctoral Independent Study (3)
Repeatable to 6 credits.

FREN 899 Doctoral Dissertation Research (1-8)

FSAD – Foodservice Administration

FSAD 415 Foodservice Cost Accounting (3)
Two hours of lecture and three hours of laboratory per week. *Prerequisite: FSAD 350.* Study of foodservice financial management and cost accounting, and utilization of computers in controlling foodservice systems.

FSAD 440 Foodservice Personnel Administration (2)
Prerequisite: FSAD 350. Personnel selection, training, scheduling, job evaluation; labor regulations and costs.

FSAD 450 Foodservice Equipment Planning (3)
Two hours of lecture and three hours of laboratory per week. *Prerequisite: FSAD 350.* Layout and design of a foodservice facility: prospectus, menu, equipment selection and maintenance. Factors affecting foodservice design and operations.

FSAD 455 Manpower Planning for Foodservice (3)
Pre- or corequisite: FSAD 350. Foodservice management responsibilities in human resource planning and development based on current theories, legislation and the foodservice labor market.

FSAD 480 Practicum in Foodservice Administration (3)
Prerequisites: FSAD 350 and permission of department. Inservice training and practical experience totaling at least 120 hours in an approved foodservice operation under direct supervision of practicum advisor.

FSAD 490 Special Problems in Foodservice (2-3)
Prerequisites: senior standing, five hours in FSAD courses and permission of department. Individual selected problems in the area of foodservice.

FSAD 498 Selected Topics (1-3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs. Selected current aspects of foodservice administration.

FSAD 600 Foodservice Administration (3)
Principles of organization and management related to a food system. Control of resources through the use of quantitative methods. Administrative decision-making, and personnel policies and practices.

FSAD 610 Readings in Food Administration (3)
Reports and discussion of significant research and development in the area of foodservice administration.

FSAD 615 Education and Training Methods for the Health Care Industry (3)
Prerequisite: permission of department. Theory and application of curriculum development, instruction and evaluation for the conduct and design of continuing education and training programs for the health care industry. The utilization and application of theories and principles of the teaching-learning process in adults.

FSAD 630 Computer Applications in Foodservice (3)
The applications of computers within foodservice operations. Basic programming concepts, the operation of personal computers, and larger computer systems. Applications of software to such topics as cost control systems and nutrition education.

FSAD 640 Sanitation and Safety in Foodservice (3)
Prerequisite: MICB 200. Principles and practices of sanitation and safety unique to the production, storage and service of food in quantity; includes current legislation.

FSAD 650 Experimental Quantity Food Production (3)
Two hours of lecture and three hours of laboratory per week. *Prerequisite: FSAD 350 or equivalent.* Application of experimental methods to quantity food production, recipe development and modification: relationship of food quality to production methods.

FSAD 660 Research Methods (3)
Prerequisite: a statistics course. A study of appropriate research methodology and theories including experimental design. Each student is required to develop a research proposal.

FSAD 665 Foodservice Systems Analysis (3)
Foodservice operations as a system or subsystem to include foodservice systems models, systems productivity, analysis and decision making in a foodservice system.

FSAD 670 Control and Analysis of Costs in Foodservice Industries (3)
Prerequisite: permission of department. Principles of controlling and analyzing costs in foodservice operations. The effects of these principles on day-to-day operations.

FSAD 675 Advanced Administrative Dietetics (3)
Prerequisite: permission of department. Open to Walter Reed dietetic interns only. A study and application of the principles and theories of management and organizational behavior management of a hospital foodservice operation.

FSAD 678 Selected Topics in Foodservice Administration (1-6)
Repeatable to 6 credits. Individual or group study in an area of institutional foodservice.

FSAD 685 Applied Foodservice Planning (3)
Recommended: FSAD 665. Decision optimization techniques applied to the planning and design of an operational foodservice system to include layout, equipment, financial statements, operational characteristics and regulatory considerations.

FSAD 688 Seminar (1)
Repeatable to 3 credits. Reports and discussion of current research in foodservice administration.

FSAD 789 Non-Thesis Research (1-3)
Directed graduate study which forms the basis of a non-thesis research paper.

FSAD 799 Master's Thesis Research (1-6)
First and second semesters. Credit in proportion to work done and results accomplished. Investigation in some phases of foodservice administration which may form the basis of a thesis.

FSAD 888 Doctoral Seminar (1)
Prerequisite: permission of department. Discussion of current research related to the foodservice industry. Presentations by doctoral students, faculty and visiting speakers.

FSAD 899 Doctoral Dissertation Research (1-8)

GEOG – Geography

GEOG 410 Colonial North America (3)
The changing geography of the U.S. and Canada from pre-Columbian times to the end of the 18th century. Emphasis on areal variations, and changes in the settlements and economies of Indian and colonial populations. Areal specialization, and the changing patterns of agriculture, industry, trade and transportation. Population growth, composition and interior expansion. Regionalization.

GEOG 411 19th Century North America (3)
An analysis of the changing geography of the U. S. and Canada from 1800 to the 1920's. The settlement, expansion and socio-economic development of the U. S., and comparisons with the Canadian experience. Immigration, economic activities, industrialization, transportation and urbanization.

GEOG 414 Historical Geography of the Hispanic World (3)
The social, economic, political and cultural geography of the countries of the Iberian peninsula and Latin America in the past with concentration on specific time periods of special significance in the development of these countries.

GEOG 416 Overseas European Colonization and the Third World (3)
The impact of European overseas expansion on Africa, Asia and Australasia during the 19th and early 20th centuries. Settlement patterns and territorial organization. Cultural and demographic change. Economic organization of space.

GEOG 420 Cultural Geography (3)
Prerequisite: GEOG 201, or GEOG 202, or ANTH 101, or ANTH 102, or permission of department. Impact of the human race through ideas and technology on the evolution of geographic landscapes. Major themes in the relationships between cultures and environments.

GEOG 421 Cultural Ecology (3)
Basic issues concerning the natural history of the human race from the perspective of the geographer. Basic components of selected behavioral and natural systems, their evolution and adaptation, and survival strategies.

GEOG 422 Population Geography (3)
The spatial characteristics of population distribution and growth, migration, fertility and mortality from a global perspective. Basic population-environmental relationships; carrying capacity, density, relationships to national development.

GEOG 423 Political Geography (3)
Geographical factors in the national power and international relations; an analysis of the role of "geopolitics" and "geostrategy," with special reference to the current world scene.

GEOG 430 Location Theory and Spatial Analysis (3)
Theories and procedures for determining the optimal location of industrial, commercial and public facilities. Techniques to evaluate location decisions. The provision of services within regions and metropolitan areas. Emerging trends.

GEOG 433 Transportation Networks (3)
Description and modeling of spatial components of transportation systems. The theory and practice of analyzing transportation networks, including nodes, links, routes, flows and regions. Examples drawn from different transportation nodes.

GEOG 434 Agricultural and Rural Development (3)
Spatial organization of agricultural resources; major types of agricultural activities in the world and their relationship to geographic conditions. Problems of conservation.

GEOG 436 Issues in Urban Transportation (3)
Spatial patterns of personal travel, movement of goods, and public transit services in cities. Transportation and land use. Public policy issues; transportation access, energy use, and neighborhood disruption. Methods of data collection and analysis, travel demand surveys.

GEOG 440 Process Geomorphology (3)
Prerequisite: GEOG 340 or GEOL 340 or permission of department. A quantitative investigation of the fundamental geomorphic processes shaping modern landscapes, with emphasis on coastal, fluvial, and glacial processes. Field, instrumentation and laboratory analyses.

GEOG 441 Geomorphological Environments (3)
Prerequisite: GEOG 201 or GEOL 100 or permission of department. Analysis of regional geomorphic environments; arctic, alpine, coastal, desert. Fluvial and glacial landscape impacts. Discussion of historical environments.

GEOG 442 Urban Climates (3)
Prerequisite: GEOG 345 or GEOG 347 or METO 301 or permission of department. Effects of cities on their climatic environment. Radiant energy budgets, urban heat islands, precipitation patterns and effects of the urban climate on human activities.

GEOG 446 Applied Climatology (3)
Prerequisite: GEOG 345 or permission of department. Components of earth's radiation balance and energy budgets: radiation, soil heat flux and the evaporation process. Measurement and estimation techniques. Practical applications of microclimatological theory and techniques.

GEOG 448 Field and Laboratory Techniques in Environmental Science (1-3)
Prerequisite: GEOG 201 or GEOL 100 or AGRO 105 or ENCE 221 or permission of department. Lecture and laboratory learning each week. A variable credit course that introduces field and

laboratory analyses in environmental science. Individual learning contracts are developed with instructor.

GEOG 450 The Contemporary City (3)
The contemporary urban system: towns, cities and metropolitan areas and their role as concentrations of social and economic activity. Patterns of land-use: residential, employment, commercial activity, manufacturing, and transportation. Explanatory and descriptive models. International comparisons.

GEOG 454 Washington, D.C.: Past and Present (3)
Development of the Washington, D.C. area from its origin as the Federal Capital to its role as a major metropolitan area. The geographic setting, the L'Enfant Plan and its modification, the federal government role, residential and commercial structure. The growth of Washington's suburbs.

GEOG 456 The Social Geography of Metropolitan Areas (3)
A socio-spatial approach to human interaction with the urban environment; ways people perceive, define, behave in, and structure their cities and metropolitan areas. Spatial patterns of social activities as formed by the distribution and interaction of people and social institutions.

GEOG 457 Historical Geography of North American Cities (3)
The urbanization of the United States and Canada prior to 1920. The evolution of the urban system across each country and the spatial distribution of activities within cities. The process of industrialization and the concurrent structuring of residential patterns among ethnic groups.

GEOG 462 Water Resources Policy and Planning (3)
Critical concepts in U.S. water resources management with emphasis on Federal fresh and surface water policy. Examination of water resources planning models, focusing on demand projections, prediction of water supply, and economic and environmental project evaluation.

GEOG 463 Geographic Aspects of Pollution (3)
Impact of human activities on the environment and resulting pollution problems. Characteristics and spatial aspects of air, water, and land resource problems. Federal legislation and planning techniques to reduce pollution.

GEOG 464 Energy Resources and Planning (3)
Regional distribution of energy resources and consumption in the U.S. Past and present patterns of energy use. Assessment of the potential of conservation, and nuclear, fossil and renewable energy resources with an emphasis on spatial impact of energy policy decisions.

GEOG 467 Energy Resources and the Environment (3)
Effects of energy resource utilization on the physical environment including land use, air and water quality, and solid waste generation. Recent laws and policies designed to reduce environmental impacts. Physical consequences of alternative energy technologies.

GEOG 470 Development of Cartographic Technology (3)
Impacts of technological improvements in land surveying and maps production of graphic and spatial images. The formation, expansion and diffusion of geographic information. Study of cartographic imagery as a changing form of communication.

GEOG 471 Cartographic Production (3)
Prerequisite: GEOG 370. Lecture and laboratory learning each week. Map making and modern methods of production and reproduction. Organization of artwork for multicolor or series map production including production planning and quality control.

GEOG 475 Principles of Map Design (3)
Prerequisite: GEOG 370. The principles of designing maps for publication in print media, including books and atlases. The selection of symbols, colors, lettering, map projections, and map content. Constraints and problems in the classification and representation of map data.

GEOG 478 Problems in Cartography (3)
Prerequisite: six credit hours in cartography or permission of department. Repeatable to 6 credits if content differs. Special topics in cartography for advanced students. Topics can include problems of cartographic management; special use maps; automated map production∂p pattern perception; tabular information from maps; map projections, transformations, and new technologies.

GEOG 480 Advanced Remote Sensing (3)
Prerequisite: GEOG 372 or introductory remote sensing course in another department. Project-oriented approach to specific applications of remote sensing. Use of numerical, digital data and pictoral images from aircraft and space vehicles. Image display and enhancement. Applications in resources management and environmental studies.

GEOG 481 Advanced Computer Mapping (3)
Prerequisite: GEOG 373 or permission of department. Advanced concepts in automated cartography. Computerized map projections and displays. Computer-assisted map design and symbolization.

GEOG 482 Geographic Information Systems (3)
Prerequisite: GEOG 373 or permission of department. The construction and use of computer-based information systems. The collection, manipulation and automated display of geographical data. Applications in areas such as resource management, political districting, terrain analysis, and community planning.

GEOG 483 Survey of Computer Facilities for Geography and Urban Studies (1)
The PRIME computer system. Graphics terminals, digitizers, plotters. File creation and use (PRIMOS), software for statistical analysis (MINITAB), relational data base management system (INFO), digitizing (DIGSRF2), contour mapping (SURFACE II), mapping of census data (CHOROMAP), symbol mapping (GIMMS). Other computer facilities on campus.

GEOG 490 Geographic Concepts and Source Materials (3)
A comprehensive and systematic survey of geographic concepts designed exclusively for teachers. Focus on philosophy of geography in relation to social and physical sciences, the use of the primary tools of geography, source materials, and the problems of presenting geographic principles.

GEOG 498 Topical Investigations (1-3)
Restricted to advanced undergraduate students with credit for at least 24 hours in geography and to graduate students. Any exceptions should have approval of department. Repeatable to 6 credits if content differs. Independent study under individual guidance.

GEOG 600 Introduction to Graduate Study in Geography (3)
Introduces the student both to research procedures needed in graduate work and to current trends and developments in geographic research. Research paper required.

GEOG 601 Field Course (3)

GEOG 605 Quantitative Spatial Analysis (3)
Prerequisite: GEOG 305; and GEOG 483, or permission of department. Multivariate statistical method applications to spatial problems. Linear and non-linear correlation and regression, factor analysis, cluster analysis. Spatial statistics including: trend surfaces, sequences, point distributions. Applications orientation.

GEOG 608 Seminar in Regional Studies (3)
Selected topics in regional geography.

GEOG 610 Research Tutorial (1-3)
Prerequisite: GEOG 600; and permission of department. Development of research proposal: critical literature review; formulation of research methodology; data identification and evaluation. Individual meetings with faculty. Proposal defense before end of semester.

GEOG 615 Geomorphology (3)
Prerequisite: GEOG 440 or permission of department. Survey and analysis of physical process in landscape evolution. Coastal processes, river mechanics and alpine glaciation.

GEOG 618 Seminar in Geomorphology (3)
Selected topics; this can include discussion of empirical and theoretical research methods applied to geomorphological problems including review of pertinent literature.

GEOG 625 Advanced Climatology (3)
Prerequisite: permission of department. Advanced study of elements and controls of the earth's climates. Analysis of the energy and water balances at earth's surface and their importance and application to life on this planet: radiation, soil heat flux, evaporation and evapotranspiration.

GEOG 628 Seminar in Climatology (3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs. Selected topics in climatology chosen to fit the individual needs of advanced students.

GEOG 638 Seminar in Environmental and Resource Management (3)
Repeatable to 6 credits if content differs. The resource management planning process, and selected topics such as energy conservation and renewable energy development, state and federal energy policies issues in land use planning, coastal areas management and water resources management.

GEOG 648 Seminar in Cultural Geography (3)
Repeatable to 6 credits if content differs. Examination of selected themes and problems in cultural geography.

GEOG 658 Seminar in Historical Geography (3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs. An examination of themes and problems in historical geography with reference to selected areas.

GEOG 668 Seminar in Economic Geography (3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs. Examination of themes and problems in the field of economic geography.

GEOG 678 Seminar in Political Geography (3)
Repeatable to 6 credits if content differs. Beginning with a review of contemporary advanced theory, the seminar will turn to problems such as the spatial consequences of political behavior, the political system and the organization of space including perceived space, the organization of political space.

GEOG 679 Seminar in Urban Geography (3)
Repeatable to 6 credits if content differs. Post-industrial urbanization; urban planning and management; metropolitan systems; internal structure of the city; use of techniques in urban locational research; transportation and land use.

GEOG 688 Seminar in Third World Devlopment (3)
Selected topics in international development for the advanced student. Core-periphery spatial exchanges, location and accessibility issues, resource constraints and opportunities, planning for rural and agricultural development, urbanization processes, emerging regional patterns.

GEOG 694 Computerized Map Projections and Transformations (3)
Prerequisite: GEOG 373 or equivalent in computer science, or permission of department. Computer generated projections; techniques for transforming one coordinate system to another; software for producing different map projections; mathematical and perceptual problems in producing and using projections.

GEOG 695 Spatial Models (3)
Prerequisite: GEOG 483 or equivalent; and GEOG 605 or equivalent. Mathematical and other models for varied subject matter. Models for point, line, area, surface spatial data contexts. Descriptive and normative models. Aggregate and dis-aggregate models. Tools for research,

planning, decision making. Information systems context. Intuitive understanding emphasized. Practical experience using several computer tools.

GEOG 696 Design for Geographic Information Systems (3)
Prerequisite: GEOG 482 or permission of department. The design, use, and management of computer based geographic information systems. Computer assisted spatial data collection, management, and display in education, government, and industry.

GEOG 698 Seminar in Cartography (1-6)
Repeatable to 6 credits if content differs. Selected topics; this can include: forensic cartography, tactile maps, design with new technologies, perception and cognitive mapping, history of cartography, laboratory management.

GEOG 699 Seminar in Computer Cartography (3)
Prerequisite: GEOG 373 or equivalent course in computer science or permission of department. Repeatable to 6 credits if content differs. Selected topics in computer-assisted cartography: algorithms for linear generalization, containing three-dimensional mapping and continuous-time mapping.

GEOG 788 Selected Topics in Geography (1-3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs. Readings and discussion on selected topics in the field of geography.

GEOG 789 Independent Readings (1-3)
Repeatable to 6 credits if content differs. Independent reading as arranged between a graduate faculty member and graduate student.

GEOG 790 Internship in Geography (3)
Field experience in the student's specialty in a federal, state, or local agency or private business. Research paper required.

GEOG 798 Independent Study (1-6)
Only open to students in the non-thesis M.A. Option.

GEOG 799 Master's Thesis Research (1-6)

GEOG 899 Doctoral Dissertation Research (1-8)

GEOL – Geology

GEOL 410 Industrial Rocks and Minerals (3)
Prerequisite: GEOL 322. The origin; occurrence; mineralogy; extraction and treatment technology; production and deposit-evaluation of rocks and minerals used in the construction, ceramic, chemical and allied industries. Restricted to non-fuels, non-metallic, non-gem materials. Field trips to industrial locations are required.

GEOL 423 Optical Mineralogy (3)
One hour of lecture and four hours of laboratory per week. *Prerequisite: GEOL 322.* The optical behavior of crystals with emphasis on the theory and application of the petrographic microscope.

GEOL 432 Biostratigraphy (3)
Two hours of lecture and three hours of laboratory per week. *Prerequisite: GEOL 331.* Principles of biostratigraphy, paleoecology and paleogeology. Laboratory study emphasizes significant index fossils.

GEOL 434 Micropaleontology (3)
Two lectures and one laboratory per week. *Prerequisite: GEOL 331.* A systematic review of the morphology, classification, ecology and geologic ranges of important microfossil groups, particularly ostracodes and foraminifera.

GEOL 436 Regional Geology of North America (3)
Prerequisite: GEOL 102. A systematic study of the regional geology of North America including history, structure, stratigraphy and petrology of the physiographic provinces of the United States, Canada and the Caribbean.

GEOL 443 Petrology (3)
Two lectures and one laboratory per week. *Prerequisite: GEOL 322.* A detailed study of rocks: petrogenesis; distributions; chemical and mineralogical relation; macroscopic descriptions and geologic significance.

GEOL 444 Petrography (3)
One lecture and two laboratories per week. *Prerequisite: GEOL 423, GEOL 342.* Microscopic thin-section studies of rocks stressing the description and classification of igneous and metamorphic rocks.

GEOL 445 Principles of Geochemistry (3)
Prerequisites: CHEM 103; and GEOL 322. An introduction to the basic principles of geochemistry including geothermometry, geobarometry, geochronology and the genesis of natural inorganic materials.

GEOL 446 Geophysics (3)
Two lectures and one laboratory per week. *Prerequisite: PHYS 142.* An introduction to the basic theories and principles of geophysics stressing such important applications as rock magnetism, gravity anomolies, crustal strain and earthquakes, and surveying.

GEOL 447 Geochemistry of Fuels (3)
Prerequisite: CHEM 104. Discussion of the progenitors and the biochemical, chemical and physical agencies that convert them into crude oils, coals of various ranks, natural gas and other organic fuels. The origin, composition, mineralogy and organic constituents (kerogen) of oil shales. Mineralogy, geochemical cycles and accumulation of uranium and thorium.

GEOL 451 Groundwater Geology (3)
Prerequisite: GEOL 100 or GEOL 101. An introduction to the basic geologic parameters associated with the hydrologic cycle. Problems in the accumulation, distribution and movement of groundwater will be analyzed.

GEOL 453 Economic Geology (3)
Two laboratories per week. *Prerequisite: GEOL 322.* A study of the geology of metallic ore deposits stressing ore-forming processes, configuration of important ore bodies, and familiarization with characteristic ore mineral suites.

GEOL 456 Engineering Geology (3)
Two lectures and one laboratory per week. *Prerequisite: GEOL 341.* A study of the geological problems associated with the location of tunnels, bridges, dams and nuclear reactors, slope control, and natural hazards.

GEOL 462 Geological Remote Sensing (3)
One lecture and two laboratories per week. *Prerequisite: GEOL 341 and GEOL 342.* An introduction to geological remote sensing including applications of aerial photographic interpretation to problems in regional geology, engineering geology, structural geology, and stratigraphy. Films, filters, and criteria used in selecting imagery are also discussed. Laboratory exercises include measurements of geologic parameters and compilation and transference of data to base maps.

GEOL 471 Geochemical Methods of Analysis (3)
Prerequisite: CHEM 103 and CHEM 113. Principles and application of geochemical analysis as applied to a variety of geological problems. X-ray and optical spectroscopy, X-ray diffraction, atomic absorption, electron microprobe and electron microscopy.

GEOL 472 Tectonics (3)
Prerequisite: GEOL 341. Selected tectonic elements of organic belts through out the world viewed in the framework of plate tectonics and sea floor spreading.

GEOL 474 Computer Modeling for Geologists (3)
Prerequisites: GEOL 331; GEOL 341; [GEOL 342 or GEOL 423]; CMSC 110. Computer modeling in the geosciences.

GEOL 490 Geology Field Camp (3)
Prerequisite: GEOL 390 or equivalent. Three-week intense field geology course taught off campus during the summer. Students describe and compile maps of formations and structures from outcrops, subsurface, and remotely sensed data. Special fees required.

GEOL 499 Special Problems in Geology (1-3)
Prerequisites: GEOL 102; and GEOL 110 or equivalent; and permission of department. Intensive study of a special geologic subject or technique selected after consultation with instructor. Intended to provide training or instruction not available in other courses which will aid the student's development in his or her field of major interest.

GEOL 501 Earth Science for Elementary/Middle School Teachers I (4)
Three hours of lecture and three hours of laboratory per week. The history of the universe, the solar system and the earth, a description of the earth's atmosphere and weather phenomena. The major minerals and rocks of the earth, and a description of the major geologic processes that change the earth's surface.

GEOL 502 Earth Science for Elementary/Middle School Teachers II (4)
Three hours of lecture and three hours of laboratory per week. *Prerequisite: GEOL 501.* Description of the earth's interior, the continents and ocean basins and an explanation of those features in terms of the theories of continental drift, sea floor spreading and plate tectonics.

GEOL 503 Earth Science for Elementary/Middle School Teachers III (4)
Three hours of lecture and three hours of laboratory per week. *Prerequisite: GEOL 502.* An intensive field study of the geology of Maryland and the Mid-Atlantic States including the Coastal Plain; Piedmont, Blue Ridge, Ridge and Valley,and Appalachian Plateau provinces.

GEOL 610 Geometrics (3)
Formulation and analysis of geologic problems employing computer and statistical modeling techniques.

GEOL 614 Thermodynamics of Geological Processes (3)
Prerequisites: MATH 141; and CHEM 113; and GEOL 322; and PHYS 142. Thermodynamics and its application to problems in mineralogy, petrology and geochemistry. Systematic development of the laws of thermodynamics and the principles of chemical equilibrium as applied to geological problems.

GEOL 621 Mineralogy of Ore-Forming Sulfides (3)
Prerequisite: GEOL 322 or equivalent. A systematic study of chemical compositions, crystal structures, and paragenetic relations of major ore-forming sulfides.

GEOL 622 Minerology of the Rock-Forming Silicates (3)
Prerequisite: GEOL 422 and CHEM 481 or equivalent. A systematic study of the structure, polymorphic relations, composition and phase transformations of the major rock forming silicates.

GEOL 623 Ore Microscopy (3)
One lecture and two laboratories per week. *Prerequisite: GEOL 423. Pre- or corequisite: GEOL 653.* A systematic study of general principles of reflected light optics and their application to the reflected light polarizing microscope as well as techniques for identifying common ore mineral in polished section.

GEOL 632 Biostratigraphy and Paleoecology (3)
Two lectures and one laboratory per week. *Prerequisite: GEOL 432.* Principles and processes of biostratigraphy and paleoecology including: controlling parameters of the marine environment; mode of life of fossil invertebrates; evolution and ecological function of populations, communities and provinces; ecological history; time and stratigraphy including sedimentary systems and correlation.

GEOL 634 Micropaleontology (3)
Two lectures and one laboratory per week. *Prerequisite: GEOL 431.* A systematic review of the morphology, classification, ecology and geologic ranges of important microfossil groups, particularly ostracoses and foraminifera.

GEOL 641 Advanced Structural Geology (3)
Two lectures and one laboratory per week. A detailed treatment of stress, strain, deformation of rocks, and resulting structures on microscopic, mesoscopic, and macroscopic scales; consideration of world examples of structural variation; concept and problems of plate tectonics; all designed as a complete study of structural geology.

GEOL 642 Sedimentary Petrography (3)
Two laboratories per week. *Prerequisite: GEOL 442 or equivalent.* Sampling and description of sediments and sedimentary rocks. Includes a statistical characterization of the mineral composition, texture, structure, and geometry of sedimentary bodies.

GEOL 643 Igneous Petrology (3)
Two laboratories per week. *Prerequisite: GEOL 443, CHEM 481.* Analysis of the genesis of the igneous rocks using chemical, mineralogic, petrographic and field data. Estimation of intensive parameters, such as temperature and pressure on the basis of these data. Interpretation of chemical variation in related rock suites in terms of fractional and equilibrium crystallization and melting processes.

GEOL 644 Metamorphic Petrology (3)
Two lectures and one laboratory per week. *Prerequisite: GEOL 443 and CHEM 481.* Analysis of the physical and chemical aspects of metamorphic processes. Suites of metamorphic rocks by the use of chemical, mineralogic, petrographic, and field data.

GEOL 653 Advanced Problems in Economic Geology (3)
Prerequisite: GEOL 453. A systematic study of particular ore deposit types or areas of mineralization, primarily involving major economically important metals. Geologic setting, mineralogy and form and character of the ore bodies, chemical and physical factors affecting source, transport and deposition of ore forming fluids.

GEOL 656 Engineering and Environmental Geology (3)
Two lectures and one laboratory per week. The relationship of humans to the planet earth; their increasing colonization based upon available food, materials, and energy; environmental consequences of resource extraction; and the desirability of planetary management policy as a long-term goal.

GEOL 660 Glacial and Quaternary Geology (3)
The dynamics, form and thermal characteristics of ice as related to glacial structures. Quaternary deposition and strata in relation to older strata as well as modern day sediments. The general lithology, morphology, and classification of till. Specific emphasis on the classical Wisconsin stage of glaciation of North America.

GEOL 663 Morphotectonics (3)
Two lectures and one laboratory per week. *Prerequisite: GEOL 462; and GEOL 664.* Interactions between surface geologic processes and recent deformation of the earth's crust. Discussion of

criteria and techniques applicable to the identification of recent folding and faulting. Surface manifestation of deep structures in areas covered by unconsolidated deposits.

GEOL 671 Analytical Methods in Minerology (3)
Two lectures and one laboratory per week. *Prerequisite: GEOL 422; and CHEM 471.* An intensive study in the operation and application of instrumentation in mineralogical problems. Emphasis on designing and testing methods of analysis for use in the student's research problems in geology.

GEOL 675 Geochemistry of Sedimentary Environments (3)
Three lectures and one laboratory per week. *Prerequisite: GEOL 442.* Application of geochemical principles and techniques to the study of authigenesis of sedimentary rocks. Emphasis on the geochemical parameters that describe recent sedimentary environments containing carbonates, clays, iron oxides and sulfides. Centering on instrumental techniques used in the study of chemical sediments, e.g. X-ray analysis, electron microscopy and luminescence petrography.

GEOL 789 Recent Advances in Geology (2-4)
Recent advances in geology research.

GEOL 798 Seminar in Geology (1)
Discussion of special topics in current literature in all phases of geology.

GEOL 799 Master's Thesis Research (1-6)

GEOL 899 Doctoral Dissertation Research (1-8)

GERM – German

GERM 401 Advanced Conversation (3)
Prerequisite: GERM 302 or equivalent. Development of fluency in spoken German. Discussion of contemporary issues.

GERM 403 Advanced Composition (3)
Prerequisite: GERM 302 or equivalent. Advanced instruction in writing skills.

GERM 405 Stylistics (3)
Prerequisite: GERM 302 or equivalent. Stylistic analysis of oral and written German both literary and non-literary. Intensive study of vocabulary and syntax. Dictionary and composition exercises.

GERM 415 German/English Translation I (3)
Not open to students who have completed GERM 111/GERM 115 and or GERM 301/GERM 302. An intensive presentation of German grammar limited exclusively to reading skill; graded readings in the arts and sciences. Instruction in English; can not be used to satisfy the arts and humanities foreign language requirement.

GERM 416 German/English Translation II (3)
Prerequisites: GERM 302 and GERM 415 or equivalent. Written translation of materials from the student's field of study. Discussion of basic problems of German-to-English translation, with examples from students' projects. Instruction in English. Cannot be used to satisfy the arts and humanities foreign language requirement.

GERM 419 Selected Topics in German Language Study (3)
Prerequisite: GERM 302 and permission of department. Repeatable to 6 credits if content differs.

GERM 421 Literature of the Middle Ages (3)
Prerequisite: GERM 321 and 322 or permission of department. German literature from the 8th through the 15th centuries. Readings include old high German texts; the German heroic, courtly and popular epic; Minnesang, Meistersang, the late Medieval epic: folk literature of the late Middle Ages. Read in modern German translation.

GERM 422 From the Reformation Through the Baroque (3)
Prerequisite: GERM 321 and GERM 322 or permission of department. Readings of representative authors from the reformation and the period of humanism through the baroque (ca. 1517-1720). Readings and instruction in German.

GERM 423 From Enlightenment through Storm and Stress (3)
Prerequisite: GERM 321 and GERM 322, or permission of department. Readings of representative authors from the Enlightenment (17201785), the Age of Sentimentalism (1740-1780), and Storm and Stress (1767-1785). Readings and instruction in German.

GERM 424 Classicism (3)
Prerequisite: GERM 321 and GERM 322, or permission of department. Readings of representative authors from the Age of Classicism (1786-1832). Readings and instruction in German.

GERM 431 Romanticism and Biedermeier (3)
Prerequisite: GERM 321 and GERM 322, or permission of department. Readings of representative authors from the periods of Romanticism (1798-1835) and Biedermeier (1820-1850). Readings and instruction in German.

GERM 432 Junges Deutschland and Realism (3)
Prerequisite: GERM 321 and 322, or permission of department. Readings of representative authors from the periods of Junges Deutschland (1830-1850) and Realism (1850-1890). Readings and instruction in German.

GERM 433 Naturalism and Its Counter Currents (3)
Prerequisite: GERM 321 and GERM 322, or permission of department. Readings of representative authors from the period of naturalism and its counter currents (1880-1920). Readings and instruction in German.

GERM 434 Expressionism to 1945 (3)
Prerequisite: GERM 321 and GERM 322, or permission of department. Readings of representative authors from Expressionism through the period between the wars to the contrast of Nazi and Exile Literature (ca. 1910-1945). Readings and instruction in German.

GERM 435 From 1945 to the Present (3)
Prerequisite: GERM 321 and GERM 322, or permission of department. Readings of representative authors from the "Two Germanies," Austria, and Switzerland in the period from the end of World War II to the present. Readings and instruction in German.

GERM 461 Reading Swedish, Danish and Norwegian I (3)
Not open to students who have completed GERM 164 or GERM 165. Develops reading facility in three languages in one semester. Texts read include Bergman's Seventh Seal, tales by H.C. Andersen, excerpts from works by Ibsen and Hamsun, and selected folk literature. No foreign language prerequisite.

GERM 462 Reading Swedish, Danish and Norwegian II (3)
Prerequisite: GERM 461 or permission of department. Further development of reading facility.

GERM 463 The Icelandic Family Saga (3)
Analysis of the old Norse saga as historiography, literature, and folklore. Readings and instruction in English.

GERM 464 The Fantastic and Historic Saga (3)
Mythological/heroic sagas, translation of chivalric materials from the continent, and the histories of the Norwegian kings, the "viking colonies" and the settlement of Iceland contrasted with the classical structure of the family saga, chivalric models, and other national histories by Germanic writers of the Middle Ages. Readings and instruction in English.

GERM 469 Selected Topics in Scandinavian Studies (3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs. Study of a linguistic, literary or cultural topic in Scandinavian studies.

GERM 472 Introduction to Germanic Philology (3)
Prerequisites: GERM 115 and GERM 471, or equivalent. Reconstructed proto-Germanic and surveys of Gothic, Old Norse, Old English, Old Saxon. The development of High German from the Old High German period through Middle High German to modern German; a short introduction to modern German dialectology. Instruction in English.

GERM 475 Old Norse (3)
The language of the old Icelandic saga, the Eddas and Skaldic poetry. Reading of texts in the original; historical development of Old Norse and its role in the Germanic language family. No knowledge of German or a Scandinavian language required; instruction in English.

GERM 479 Selected Topics in Germanic Philology (3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs. Selected topics such as comparative Germanic studies, Old Norse language or readings in Old Norse literature, modern German dialectology.

GERM 499 Directed Study (1-3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs.

GERM 610 Structure of the German Language (3)
An introduction to applied linguistics. Structural analysis of the phonetics, phonology, morphology, syntax and lexicon of modern German contrasted with that of modern English.

GERM 611 College Teaching of German (3)
Instruction, demonstration and classroom practice under supervision of modern procedures in the presentation of elementary German courses to college age students.

GERM 620 Methods and Concepts of Germanic Studies (3)
The history, methods and concepts of Germanic Studies (language and literature).

GERM 621 Middle High German Literature I (3)
Form and structure of the medieval verse narrative; treatment of the most important authors and works of the period.

GERM 622 Middle High German Literature II (3)
Form and structure of medieval lyric poetry; treatment of the most important authors of the period.

GERM 631 German Lyric Poetry (3)
An exposition of the genre of lyric poetry, its metrical and aesthetic background, illustrated by characteristic examples from the Middle Ages to the present.

GERM 632 The German Novelle (3)
Study of the development of the genre from the 18th century to the present.

GERM 633 The German Novel (3)
The theory and structure of the German novel from the Baroque to the present.

GERM 634 German Drama (3)
An introduction to the theory and structure of the German drama from the Baroque to the present with extensive interpretation of characteristic works.

GERM 671 Gothic, Old High German, Middle High German I (3)
The first semester of a two-semester practicum in reading Gothic, Old and Middle High German, with emphasis on linguistic analysis.

GERM 692 Research Techniques: Bibliography and Manuscript Preparation (1)
Bibliographic verification and search resources and techniques. The preparation of a scholarly manuscript: format, editing, and proofreading.

GERM 693 Research Techniques: Formating (1)
Scholarly formats - the abstract, review, report, essay, article and monograph related to purpose, structure, and limitations.

GERM 694 Research Techniques: Materials Production (1)
The production of camera-ready copy for academic use.

GERM 798 Master's Independent Study (1-3)
Prerequisite: consent of instructor. Repeatable to 6 credits if content differs.

GERM 799 Master's Thesis Research (1-6)

GERM 818 Seminar: The Middle Ages (3)
Repeatable to 9 credits if content differs. Study of one or more representative authors or works of the Middle Ages.

GERM 819 Seminar: The 16th and 17th Centuries (3)
Repeatable to 9 credits if content differs. The German literature of the Humanists, the Reformation and the Baroque as illustrated by study of one or more authors of the 16th or 17th centuries.

GERM 828 Seminar: The 18th Century (3)
Repeatable to 9 credits if content differs. Study of one or more authors from the Enlightenment, Sentimentalism, Stress, or Classicism periods.

GERM 829 Seminar: The 19th Century (3)
Repeatable to 9 credits if content differs. Study of one or more authors of Romanticism, Biedermeier, Young Germany or Realism.

GERM 838 Seminar: The 20th Century (3)
Repeatable to 9 credits if content differs. Study of a literary movement or of one or more authors from the period of Naturalism to the present.

GERM 839 Seminar: Special Topics (3)
Repeatable to 9 credits if content differs. Study of a topic of a general nature and not limited to any specific century.

GERM 879 Seminar in Germanic Philology (3)
Repeatable to 9 credits if content differs. In depth study of a topic in Germanic or Indo-European philology comparative Germanic grammar, runology, dialect geography, Eddic or Skaldic poetry, Indo-European studies.

GERM 889 Seminar in Germanic Area Studies (3)
Repeatable to 9 credits if content differs. Comprehensive study of a selected topic in German or Germanic area studies: history of ideas, cultural history, Germanic literatures other than German, folk literature and folklore.

GERM 898 Doctoral Independent Study (1-3)
Prerequisite: permission of instructor. Repeatable to 6 credits if content differs.

GERM 899 Doctoral Dissertation Research (1-8)

GREK – Greek

GREK 402 Greek Philosophers (3)

GREK 403 Greek Tragedy (3)

GREK 404 Greek Comedy (3)

GREK 406 Greek Epigraphy (3)

GREK 488 Greek Readings (1-3)
Prerequisite: permission of department. May be repeated if content differs. The reading of one or more selected Greek authors. Reports.

GREK 490 Survey of Greek Literature (3)
Greek literature, including authors, genres and periods. The reading of selections from many of the major authors, combined with the study of the history of Greek literature. Review of Greek grammar.

GREK 499 Independent Study in Greek Language and Literature (3)
Prerequisite: permission of department. Repeatable to 6 credits.

GREK 602 Plato and Aristotle (3)
Readings from the works of Plato and Aristotle: an examination of their philosophies and literary qualities.

GREK 603 Greek Tragedy (3)
The reading of two tragedies of the Athenian tragedians. Detailed discussion of historical background, literary art, thought, and the circumstances and manner of their production. Other tragedies will be read in English.

GREK 604 Homer (3)
The extensive and intensive reading of Homer, with concentration on one of his two epics. Discussion of the language, artistic qualities, and thought of the poems, and of modern views concerning their orgin and literary qualities.

GREK 606 Greek Historians (3)
Survey of the Greek historians, concentrating on Herodotus and Thucydides, contrasting the two historians in the areas of subject, methods of research, composition, and achievement.

GREK 688 Special Topics in Greek Literature (3)
Repeatable to 9 credits if content differs.

GREK 699 Independent Study in Greek Literature (1-3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs.

GREK 799 Master's Thesis Research (1-6)

GVPT – Government and Politics

GVPT 401 Problems of World Politics (3)
Prerequisite: GVPT 200. A study of governmental problems of international scope, such as causes of war, problems of neutrality, and propaganda. Students are required to report on readings from current literature.

GVPT 402 International Law (3)
Prerequisite: GVPT 200. A study of the basic character, general principles and specific rules of international law, with emphasis on recent and contemporary trends in the field and its relation to other aspects of international affairs.

GVPT 403 Law, Morality and War (3)
Prerequisite: GVPT 200. An exploration of fundamental moral and legal issues concerning war.

GVPT 405 Defense Policy and Arms Control (3)
Prerequisite: GVPT 200. Contemporary issues of military strategy and international security are covered, including: nuclear war, conventional (limited) war, guerrilla insurgency, arms control, disarmament, moderation of war, defense policy processes, and defense economics.

GVPT 411 Public Personnel Administration (3)
Prerequisite: GVPT 210. A survey of public personnel administration, including the development of merit civil service, the personnel agency, classification, recruitment, examination techniques, promotion, service ratings, training, discipline, employee relations, and retirement.

GVPT 412 Public Financial Administration (3)
Prerequisite: GVPT 210. A survey of governmental financial procedures, including processes of current and capital budgeting, the administration of public borrowing, the techniques of public purchasing, and the machinery of control through pre-audit and post-audit.

GVPT 413 Governmental Organization and Management (3)
Prerequisite: GVPT 210. A study of the theories of organization and management in American government with emphasis on new trends, experiments and reorganizations.

GVPT 414 Administrative Law (3)
Prerequisite: GVPT 210. A study of the discretion exercised by administrative agencies, including analysis of their functions, their powers over persons and property, their procedures, and judical sanctions and controls.

GVPT 422 Quantitative Political Analysis (3)
Prerequisite: GVPT 220. Introduction to quantitative methods of data analysis, including selected statistical methods, block analysis, content analysis, and scale construction.

GVPT 423 Elections and Electoral Behavior (3)
Prerequisite: GVPT 220. An examination of various topics relating to elections; the focus includes the legal structure under which elections are conducted, the selection and nomination process, the conduct of election campaigns, and patterns of political participation and voting choice in different types of elections.

GVPT 426 Public Opinion (3)
Prerequisite: GVPT 220. An examination of public opinion and its effect on political action, with emphasis on opinion formation and measurement, propaganda and pressure groups.

GVPT 427 Political Sociology (3)
Prerequisite: GVPT 220. A study of the societal aspects of political life including selected aspects of the sociology of group formation and group dynamics, political association, community integration and political behavior.

GVPT 429 Problems in Political Behavior (3)
Prerequisite: GVPT 220. The problem approach to political behavior with emphasis on theoretical and empirical studies on selected aspects of the political process.

GVPT 431 Introduction to Constitutional Law (3)
Prerequisite: GVPT 231. A systematic inquiry into the general principles of the American constitutional system, with special reference to the role of the judiciary in the interpretation and enforcement of the federal constitution.

GVPT 432 Civil Rights and the Constitution (3)
Prerequisite: GVPT 231. A study of civil rights in the American constitutional context, emphasizing freedom of religion, freedom of expression, minority discrimination, and the rights of defendants.

GVPT 433 The Judicial Process (3)
Prerequisite: GVPT 231. An examination of judicial organization in the United States at all levels of government, with some emphasis on legal reasoning, legal research and court procedures.

GVPT 434 Race Relations and Public Law (3)
Prerequisite: GVPT 231. A political and legal examination of the constitutionally protected rights affecting racial minorities and of the constitutional power of the federal courts, congress, and the executive to define, protect and extend these rights.

GVPT 436 The Legal Status of Women (3)
Prerequisite: GVPT 231. An examination of judicial interpretation and application of common, statutory, and constitutional law as these affect the status of women in American society.

GVPT 441 History of Political Theory: Ancient and Medieval (3)
Prerequisite: GVPT 100. A survey of the principal political theories set forth in the works of writers before Machiavelli.

GVPT 442 History of Political Theory--Medieval to Recent (3)
Prerequisite: GVPT 100. A survey of the principal theories set forth in the works of writers from Machiavelli to Nietzsche.

GVPT 443 Contemporary Political Theory (3)
Prerequisite: GVPT 100. A survey of the principal political theories and ideologies set forth in the works of writers from Karl Marx to the present.

GVPT 444 American Political Theory (3)
Prerequisite: GVPT 100 or GVPT 170. A study of the development and growth of American political concepts from the Colonial period to the present.

GVPT 445 Russian Political Thought (3)
Prerequisite: GVPT 100. A survey and analysis of political ideas in Russia and the Soviet Union from early times to the present.

GVPT 448 Non-Western Political Thought (3)
Prerequisite: GVPT 100; permission of department required for repeat. Examination of works by major authors and general themes of political thought originating in Asia, the Middle East, and Africa. This is not a survey of all non-western political thought, but a course to be limited by the professor with each offering.

GVPT 450 Comparative Study of Foreign Policy Formation (3)
Prerequisite: GVPT 200. The opportunity to learn the theoretical underpinnings of foreign policy decision-making and to apply this knowledge in a simulation of a "real world" negotiation arena.

GVPT 451 Foreign Policy of the U.S.S.R. (3)
Prerequisite: GVPT 280 or GVPT 282. A study of the development of the foreign policy of the Soviet Union, with attention paid to the forces and conditions that make for continuities and changes from Tsarist policies.

GVPT 453 Recent East Asian Politics (3)
Prerequisite: GVPT 280 or GVPT 282. The background and interpretation of recent political events in East Asia and their influence on world politics.

GVPT 454 Contemporary African Politics (3)
Prerequisite: GVPT 280 or GVPT 282. A survey of contemporary development in the international politics of Africa, with special emphasis on the role of an emerging Africa in world affairs.

GVPT 455 Contemporary Middle Eastern Politics (3)
Prerequisite: GVPT 280 or GVPT 282. A survey of contemporary development in the international politics of the Middle East, with special emphasis on the role of emerging Middle East nations in world affairs.

GVPT 457 American Foreign Relations (3)
Prerequisite: GVPT 200. The principles and machinery of the conduct of American foreign relations, with emphasis on the Departments of State and Defense, and an analysis of the major foreign policies of the United States.

GVPT 460 Problems in State and Local Government (3)
Prerequisite: GVPT 260. A study of the structure, procedures and policies of state and local governments with special emphasis on the state level and on intergovernmental relationships, and with illustrations from Maryland governmental arrangments.

GVPT 461 Metropolitan Government (3)
Prerequisite: GVPT 260. An examination of administrative problems relating to public services, planning and coordination in a metropolitan environment.

GVPT 462 Urban Politics (3)
Prerequisite: GVPT 260. Urban political process and institutions considered in the light of changing social and economic conditions.

GVPT 471 Women and Politics (3)
Prerequisite: GVPT 170. An examination of patterns of political participation among women and of problems of public policy especially relevant to women.

GVPT 473 Legislatures and Legislation (3)
Prerequisite: GVPT 170. A detailed survey of lawmaking and the legislative process, emphasizing the U.S. Congress and its members.

GVPT 474 Political Parties (3)
Prerequisite: GVPT 170. A descriptive and analytical examination of American political parties, nominations, elections, and political leadership.

GVPT 475 The Presidency and the Executive Branch (3)
Prerequisite: GVPT 170. An examination of the U.S. presidency in historical and contemporary perspective: nomination and electoral politics and the president's place in policy-making, administration, and public opinion.

GVPT 479 Problems of American Public Policy (3)
Prerequisite: GVPT 170. The background and interpretation of various factors which affect the formation and execution of American public policy.

GVPT 480 Comparative Political Systems (3)
Prerequisite: GVPT 280 or GVPT 282. A study, along functional lines, of major political institutions, such as legislatures, executives, courts, bureaucracies, public organizations, and political parties.

GVPT 481 Government and Administration of the Soviet Union (3)
Prerequisite: GVPT 280 or GVPT 282. A study of the adoption of the communist philosophy by the Soviet Union, of its governmental structure and of the administration of government policy in the Soviet Union.

GVPT 482 Government and Politics of Latin America (3)
Prerequisite: GVPT 280 or GVPT 282. A comparative study of the governmental systems and political processes of the Latin American countries.

GVPT 483 Government and Politics of Asia (3)
Prerequisite: GVPT 280 or GVPT 282. A comparative study of the political systems of China, Japan, India and other selected Asian countries.

GVPT 484 Government and Politics of Africa (3)
Prerequisite: GVPT 280 or GVPT 282. A comparative study of the governmental systems and political processes of the African countries, with special emphasis on the problems of nation-building in emergent countries.

GVPT 485 Government and Politics of the Middle East (3)
Prerequisite: GVPT 280 or GVPT 282. A comparative study of the governmental systems and political processes of the Middle Eastern countries, with special emphasis on the problems of nation-building in emergent countries.

GVPT 486 Comparative Studies in European Politics (3)
Prerequisite: GVPT 280 or GVPT 282. Comparative studies in the forms of governance, political processes, and public policies in European countries.

GVPT 492 The Comparative Politics of Race Relations (3)
Prerequisite: GVPT 280 or GVPT 282. Impact of government and politics on race relations in various parts of the world. The origins, problems, and manifestations of such racial policies as segregation, apartheid, integration, assimilation, partnership, and nonracialism will be analyzed.

GVPT 599 Teaching Political Science (1)
Problems in teaching political science. Topics covered include lecture and discussion strategies, creation of an active learning environment, construction and evaluation of examinations, department and university policies, and dealing with various types of teaching problems. This course does not carry credit towards any degree at the University.

GVPT 622 Quantitative Methods For Political Science (3)
Introduction to quantitiative methods of data analysis, with emphasis on statistical methods and computer usage. Measures of association, probability, correlation, linear regression estimation techniques, introductory analysis of variance, and use of package computer programs.

GVPT 700 Scope and Method of Political Science (3)
Required of all Ph.D. candidates. A seminar in the methodologies of political science, and their respective applications to different research fields. Interdisciplinary approaches and bibliographical techniques are also reviewed.

GVPT 708 Seminar in International Relations Theory (3)
Repeatable to 6 credits if content differs. An examination of the major approaches, concepts, and theories in the study of world politics with special emphasis on contemporary literature.

GVPT 710 Introduction to Graduate Study in Public Administration (3)
An examination of the history, background, and trends of public administration and the basic concepts and the approaches utilized in the organizational process of public bureaucracies. Readings from textual sources will include the following: the study of public administration, the societal and political environment, organization theory and behavior, administrative law, comparative and development administration, policy and systems analysis, program planning and budgeting, manpower resources development, organizational performance and accountability.

GVPT 722 Advanced Quantitative Methods For Political Science (3)
Prerequisite: GVPT 622 or permission of instructor. Introduction to multivariate analysis. Elementary matrix algebra, multiple linear and curvilinear correlation and regression, analysis of variance, canonical correlation and regression, discriminant analysis, and several types of factor analysis.

GVPT 729 Special Topics in Quantitative Political Analysis (3)
Prerequisite: GVPT 622 or permission of instructor. Repeatable to 6 credits if content differs. An intensive examination of special topics in quantitative methods of political analysis in such areas as survey research methods, exploratory data analysis, advanced data management techniques, or advanced methods of policy analysis.

GVPT 730 Methods of Formal Political Theory (3)
An introduction to the methods of formal theory, with emphasis on selected aspects of philosophy of science and on propositional and quantified logic. The limitations and potentialities of formal theory in both normative and empirical political science.

GVPT 741 Political Theory (3)
A graduate level introduction to the history of political philosophy and political theory.

GVPT 750 Policy Evaluation (3)
An examination of the application of social indicators and accounts, field and laboratory experimentation, formal modeling, and other techiques drawn from the social sciences to problems of public policy selected from various levels of the political system.

GVPT 770 Seminar in American Political Institutions (3)
Reports on topics assigned for individual study and reading in the background and development of American government.

GVPT 780 Seminar in the Comparative Study of Politics (3)
An examination of the salient approaches to and conceptual frameworks for the comparative study of politics, followed by the construction of models and typologies of political systems.

GVPT 799 Master's Thesis Research (1-6)

GVPT 802 Seminar in International Law (3)
Reports on selected topics assigned for individual study and reading in substantive and procedural international law.

GVPT 803 Seminar in International Political Organization (3)
A study of the forms and functions of various international organizations.

GVPT 807 Comparative Studies in International Relations (3)
Prerequisite: GVPT 708; or GVPT 780; or permission of department. Studies in the historical, areal, structural, social and economic contexts of international relations and the influences of international relations on domestic politics, social relations and economics.

GVPT 808 Selected Topics in Functional Problems in International Relations (3)
An examination of the major substantive issues in contemporary international relations.

GVPT 810 Governmental Organization Theory (3)
A study of recent developments in the area of organizational theory with an emphasis on empirical studies of organizational behavior.

GVPT 812 Seminar in Public Financial Administration (3)
Readings and reports on topics assigned for individual or group study in the field of public financial administration.

GVPT 813 Problems of Public Personnel Administration (3)
Reports on topics assigned for individual study and reading in the field of public personnel administration.

GVPT 815 Government Administrative Planning and Management (3)
Reports on topics assigned for individual study and reading in administrative planning and management in government.

GVPT 816 Studies in Comparative Governmental Administration (3)
An examination of theoretical concepts and empirical findings in the field of comparative administation. Individual readings and research dealing with the civil services of western and non-western nations will be assigned.

GVPT 818 Problems of Public Administration (3)
Reports on topics assigned for individual study and reading in the field of public administration.

GVPT 827 Seminar in Political Sociology (3)
Prerequisite: GVPT 427 or equivalent. Inquiries into the conceptual and theoretical foundations of and empirical data in the field of political sociology. Individual readings and research problems will be assigned, dealing with the social contexts of politics and the political aspects of social relationships.

GVPT 828 Selected Problems in Political Behavior (3)
Individual reading and research reports on selected problems in the study of political behavior.

GVPT 831 Formal Theories of Politics (3)
Prerequisite: GVPT 730 or permission of instructor. Survey of major formal theories of politics, with emphasis on those theories based on the assumptions of rationality. The theory of public goods, game theory, coalition theory, and the theoretical properties of voting systems.

GVPT 838 Topics in Formal Political Theory (3)
Prerequisite: GVPT 831 or permission of instructor. An examination of selected topics in formal theory. Theories of justice, the voters paradox, the liberal paradox, the effects of costly information, and theories of regulation.

GVPT 841 Great Political Thinkers (3)
Prerequisite: GVPT 441. Intensive study of one or more men each semester.

GVPT 842 Man and the State (3)
Prerequisite: GVPT 442. Individual reading and reports on such recurring concepts in political theory as liberty, equality, justice, natural law and natural rights, private property, sovereignty, nationalism and the organic state.

GVPT 844 American Political Theory (3)
Prerequisite: GVPT 444. Analytical and historical examination of selected topics in American political thought.

GVPT 845 Marxist Political Theory (3)
Prerequisite: GVPT 443 or permission of instructor. Intensive study and analysis of the leading ideas of Marx and Engels and their development in the different forms of social democracy and of communism.

GVPT 846 Theories of Democracy (3)
Prerequisite: GVPT 442. A survey and analysis of the leading theories of democratic government, with attention to such topics as freedom, equality, representation, dissent, and critics of democracy.

GVPT 847 Seminar in Non-Western Political Theory (3)
Intensive study of selected segments of political theory outside of the Western European tradition.

GVPT 848 Current Problems in Political Theory (3)
Prerequisite: GVPT 443. Intensive examination of the development of political theory since the Second World War.

GVPT 850 Applied Foreign Policy Analysis (3)
Individual research and reporting on standards of policy performance and analysis with emphasis on data display, information organization, forecasting, and rational resource allocation.

GVPT 857 Seminar in American Foreign Relations (3)
Reports on selected topics assigned for individual study and reading in American foreign policy and the conduct of American foreign relations.

GVPT 859 Selected Topics in Public Policy (3)
Prerequisite: GVPT 750 or permission of instructor. Repeatable to 6 credits if content differs. An examination of selected topics in public policy, such as judicial education, health, welfare, and resources policy.

GVPT 862 Seminar On Intergovernmental Relations (3)
Reports on topics assigned for individual study and reading in the field of recent intergovernmental relations.

GVPT 868 Problems of State and Local Government (3)
Report of topics assigned for individual study in the field of state local government throughout the United States.

GVPT 869 Seminar in Urban Administration (3)
Selected topics are examined by the team research method with students responsible for planning, field investigation, and report writing.

GVPT 871 Seminar in Public Law (3)
Reports on topics for individual study and reading in the fields of constitutional and administrative law.

GVPT 872 Judicial Process and Behavior (3)
An examination and assessment of the various social scientific approaches to the study of judicial behavior and process. The "behavioral" public law, featuring the application of social science research techniques to the study of the legal process.

GVPT 873 Seminar in Legislatures and Legislation (3)
Reports on topics assigned for individual study and reading about the composition and organization of legislatures and about the legislative process.

GVPT 874 Seminar in Political Parties and Politics (3)
Reports on topics assigned for individual study and reading in the fields of political organization and action.

GVPT 875 Seminar in Judicial Policy Development (3)
The role of courts in policy development, the extent and limitations of judicial power, the division of labor among courts in creating policy, and the politics of litigation.

GVPT 876 Seminar in National Security Policy (3)
An examination of the components of United States security policy. Factors, both internal and external, affecting national security will be considered. Individual reporting as assigned.

GVPT 878 Problems in American Government and Politics (3)
An examination of contemporary problems in various fields of government and politics in the United States, with reports on topics assigned for individual study.

GVPT 879 Topics on International Security (3)
Recommended: GVPT 876 or equivalent. Repeatable to 6 credits if content differs. A detailed and advanced analysis of particular regional problems on defense policy and arms control.

GVPT 881 Comparative Governmental Institutions: Soviet Union (3)
An examination of government and politics in the Soviet Union.

GVPT 882 The Government and Politics of Japan (3)
Contemporary policy-making process and economic and foreign policies of Japan in the context of postwar reforms, the roles of the bureaucracy, business, and the conservative party, Japanese pacifism, and strategic cooperation and economic relations with America.

GVPT 883 Comparative Governmental Institutions: Asia (3)
An examination of governments and politics within Asia.

GVPT 885 Comparative Governmental Institutions: Middle East (3)
An examination of governments and politics within the Middle East.

GVPT 886 Comparative Governmental Institutions: Europe (3)
An examination of governments and politics within Europe.

GVPT 887 Seminar in the Politics of Developing Nations (3)
An examination of the programs of political development in the emerging nations with special references to the newly independent nations of Asia and Africa, and the less developed countries of Latin America. Individual reporting as assigned.

GVPT 888 Selected Topics in Comparative Governmental Institutions (3)
An examination of special topics in comparative politics.

GVPT 889 Selected Topics in Area Problems in International Relations (3)
Special topics concerning regional problems in the relations of states.

GVPT 898 Readings in Government and Politics (3)
Guided readings and discussions on selected topics in political science.

GVPT 899 Doctoral Dissertation Research (1-8)

HEBR – Hebrew

HEBR 401 Introduction to Classical Hebrew I (3)
Readings in the Bible and other classical texts in original Hebrew. Emphasis on classical grammar and vocabulary, and reading of textual passages.

HEBR 402 Introduction to Classical Hebrew II (3)
Prerequisite: HEBR 401 or equivalent. Continuation of HEBR 401.

HEBR 431 Modern Hebrew Literature (3)
Prerequisite: HEBR 314 or equivalent. Selected readings from the major Hebrew prose writers of the 20th century such as J. Steinberg, Burla, Berkovitz, Shofman and Agnon describing traditional Jewish life in the Diaspora Mileu and in the land of Israel.

HEBR 432 Contemporary Hebrew Literature (3)
Prerequisite: HEBR 314 or equivalent. The problems facing modern man as reflected in the writings of Agnon, Hazaz, Meged, Yehoshua, Amichai, and others. Training in literary criticism. Reading of periodicals dealing with current literary trends.

HEBR 441 Studies in Classical Hebrew and Epigraphy (3)
Prerequisite: HEBR 212 or equivalent. Linguistic peculiarities of Classical Hebrew from Pre-Biblical epigraphic records to the Dead Sea Scrolls. Application of the method of literary form criticism to epic poetry and Thanksgiving songs, cultic formulae, historical annals and narratives.

HEBR 442 Classical Hebrew Literature (3)
Prerequisite: HEBR 212 or knowledge of Classical Hebrew. Readings in the Hebrew text of the Bible and related texts. Emphasis on the issues and methodology of modern biblical scholarship.

HEBR 471 Readings in Rabbinic Hebrew (3)
Prerequisite: HEBR 212 or permission of department. Introductory readings in Mishnaic and Talmudic Hebrew texts. Language of instruction English; all texts in Hebrew.

HEBR 472 Readings in Medieval Hebrew (3)
Prerequisite: HEBR 212 or permission of department. Introductory readings in Medieval Hebrew texts. Language of instruction English; all texts in Hebrew.

HEBR 498 Special Topics in Hebrew (3)
Repeatable to 6 credits if content differs.

HESP – Hearing and Speech Sciences

HESP 400 Speech and Language Development in Children (3)
Prerequisite: HESP 300. Analysis of the normal processes of speech and language development in children.

HESP 401 Introduction to Communication Disorders (3)
Disorders of hearing, language and speech for non-majors. Communication disorders in children and adults, with emphasis on etiologies, characteristics, assessment and management.

HESP 402 Speech Pathology I (3)
Prerequisite: HESP 300. Etiology, assessment and treatment of language and phonological disorders in children.

HESP 403 Introduction to Phonetic Science (3)
Prerequisite: HESP 305. An introduction to physiological, acoustic and perceptual phonetics; broad and narrow phonetic transcription; current models of speech production and perception.

HESP 404 Speech Pathology II (3)
Prerequisite: HESP 305. Etiology, assessment and therapeutic management of phonation, resonance, and fluency disorders in children and adults.

HESP 406 Speech Pathology III (3)
Prerequisite: HESP 303, HESP 305. Survey of the dysarthrias and aphasias in adults from an interdisciplinary point of view.

HESP 407 Bases of Hearing Science (3)
Prerequisite: HESP 311. Fundamentals of hearing including the physics of sound, anatomy and physiology of peripheral and central auditory nervous system, psychophysical procedures used in measurement of auditory sensation and perception and topics in psychological acoustics.

HESP 411 Introduction to Audiology (3)
Prerequisite: HESP 311. An introduction to the field of audiology. Evaluation and remediation of the hearing-handicapped.

HESP 417 Principles and Methods in Speech-Language Pathology and Audiology (3)
Prerequisite: HESP 402, HESP 411. The principles underlying the treatment of speech, language and hearing disorders in children and adults.

HESP 418 Clinical Practice in Speech-Language Pathology and Audiology (3)
Prerequisite: HESP 417. Repeatable to 6 credits. Supervised observation with some direct participation in clinical methods for the treatment of disorders of articulation, fluency, child and adult language; evaluation and habilitation/rehabilitation of hearing impaired children and adults.

HESP 438 Seminar: Special Issues in Early Childhood Special Education (1-3)

HESP 498 Seminar (3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs. Selected topics in human communication and its disorders.

HESP 499 Independent Study (1-3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs. A directed study of selected topics pertaining to human communication and its disorders.

HESP 600 Instrumentation in Hearing and Speech Sciences (3)
Prerequisite: permission of department. Types and principles of operation of electronic equipment used in the hearing and speech sciences.

HESP 602 Neurological Bases of Human Communication (3)
Prerequisite: permission of department. Basic neurology as it pertains to anatomical and physiological substrates of speech and language.

HESP 604 Acoustical and Perceptual Phonetics (3)
Prerequisite: permission of department. Principles and current laboratory techniques in analysis of the acoustical characteristics of the speech signal and discussion of models of speech perception.

HESP 606 Basic Hearing Measurements (3)
Prerequisite: HESP 411 or equivalent. Theoretical principles, methodology, and interpretation of routine audiometric tests, including pure tone, speech, and acoustic immittance measures. Modification of procedures for special populations. Equipment calibration and mass hearing screening programs.

HESP 610 Aphasia (3)
Language problems of adults associated with brain injury.

HESP 612 Fluency Disorders (3)
Prerequisite: permission of department. The nature of fluency disorders. Principles, methods and procedures for the clinical management of fluency disorders in children and adults.

HESP 614 Orofacial Anomalies (3)
Prerequisite: permission of department. Communication disorders related to congenital orofacial anomalies with an emphasis on cleft lip and palate. Principles, methods and procedures for clinical management.

HESP 616 Language Disorders in Children (3)
Prerequisite: HESP 400 or equivalent or permission of department. Theoretical, empirical and clinical perspectives.

HESP 620 Phonological and Articulatory Disorders (3)
Assessment and treatement of disorders at the phonological and articulatory levels of language and speech.

HESP 622 Neuromotor Disorders of Speech (3)
Prerequisite: permission of department. Effects of neuropathology on speech production. Classification and assessment of the resultant disorders and their treatment.

HESP 624 Voice Disorders (3)
Prerequisite: permission of department. Etiology characteristics, assessment and treatment of phonatory disorders in children and adults.

HESP 626 Language and Learning Disabilities (3)
Etiology, assessment and treatment of communication problems in children with learning disabilities.

HESP 630 Electrophysiological Measurements (3)
Prerequisite: HESP 606 or permission of department. Principles and techniques of physiological and electrophysiological measures of the audio-vestibular mechanisms.

HESP 634 Medical Aspects of Speech and Hearing Disorders (1-3)
Lectures by physicians on embryological, anatomical, physiological, and neurological bases of speech and hearing disorders.

HESP 635 Aural Rehabilation/Habilitation (3)
Principles, methods and procedures for aural rehabilitation/habilitation in children and adults.

HESP 638 Research Practicum (1-3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs. Analysis, synthesis and integration of knowledge related to current research or clinical issues in human communication and its related disorders.

HESP 639 Special Topics in Hearing and Speech Sciences (1-3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs. Intensive coverage of selected topics of current interest.

HESP 640 Advanced Principles of Hearing and Speech Therapy (3)
Analysis of the clinical process with emphasis on the application of learning theory to treatment of speech disorders.

HESP 645 Pediatric Audiology (3)
Prerequisite: HESP 606 or permission of department. Evaluation and treatement of hearing-impaired children.

HESP 648 Clinical Practice in Speech (1-3)
Prerequisite: permission of instructor. Repeatable to 6 credits. Supervised training in the application of clinical methods in the diagnosis and treatment of speech disorders.

HESP 649 Clinical Practice in Audiology (1-3)
Prerequisite: permission of instructor. Repeatable to 6 credits. Supervised training in the application of clinical methods in the diagnosis and treatment of hearing disorders.

HESP 700 Hearing Aids (3)
Principles, methods and procedures for selection, filing, calibration and management of amplification systems for hearing-impaired children and adults.

HESP 702 Diagnostic Procedures in Speech-Language Pathology (3)
Diagnostic tools and methods in the analysis of speech-language disorders in children and adults.

HESP 704 Physiological Phonetics (3)
Prerequisite: HESP 604. Laboratory techniques in the study of the speech mechanism.

HESP 706 Advanced Clinical Audiology (3)
Prerequisite: HESP 606 or equivalent. Advanced clinical and experimental methods of evaluating the peripheral and central auditory system using acoustic stimuli. Procedural considerations and interpretation of test results.

HESP 708 Independent Study (1-6)
Prerequisite: permission of instructor. Repeatable to 6 credits. Individual research projects under guidance of a faculty member.

HESP 710 Industrial and Environmental Noise Problems (3)
Prerequisite: permission of instructor. Evaluation and control of noise hazards. Effects of noise on man. Medico-legal aspects of noise-induced hearing impairment.

HESP 720 Auditory Systems: Anatomy, Physiology and Disorders (3)
Gross and fine structure, and function, of the peripheral and central auditory system. Pathologies of the peripheral hearing mechanism.

HESP 722 Experimental Audiology (3)
Experimental techniques in the investigation of problems in audiology.

HESP 724 Research Design (3)
Prerequisite: a course in basic statistics. Evaluations of research designs, critique of published articles and student involvement in designing experiments on assigned topics.

HESP 728 Advanced Clinical Practice in Speech (1-8)
Prerequisite: HESP 648 and permission of instructor. Repeatable to 8 credits. Clinical internship in selected off-campus facilities.

HESP 729 Advanced Clinical Practice in Audiology (1-8)
Prerequisite: HESP 649 and permission of instructor. Repeatable to 8 credits. Clinical internship in selected off-campus facilities.

HESP 799 Master's Thesis Research (1-6)

HESP 804 Instrumental Phonetics (3)
Prerequisite: HESP 604 and HESP 704 or permission of instructor. Instrumental techniques in phonetic science.

HESP 806 Administration of Hearing and Speech Programs (3)
Problems of staffing, budgeting, and operating traning and clinical service programs.

HESP 810 Experimental Design in Hearing and Speech Science (3)
Prerequisite: HESP 724 or permission of instructor. Design and evaluation of research projects. Preparation for undertaking the doctoral dissertation.

HESP 820 Bioacoustics (3)
Prerequisite: permission of instructor. Functioning of the hearing mechanism in animals and humans. Laboratory research methods.

HESP 822 Psychoacoustics (3)
Prerequisite: permission of instructor. Study of human response to acoustic stimulation.

HESP 826 Neurophysiology of Hearing (3)
Processing of stimuli by the auditory nervous system.

HESP 848 Seminar in Audiology (3)
Prerequisite: permission of instructor. Repeatable to 6 credits.

HESP 858 Seminar in Speech Pathology (3)
Prerequisite: permission of instructor. Repeatable to 6 credits.

HESP 868 Seminar in Speech Science (3)
Prerequisite: permission of instructor. Repeatable to 6 credits.

HESP 878 Seminar in Language Disorders (3)
Prerequisite: permission of instructor. Repeatable to 6 credits.

HESP 899 Doctoral Dissertation Research (1-8)

HISP – Historic Preservation

HISP 600 Seminar in Historic Preservation (3)
A team taught introduction to the total range of preservation as well as the contributions of participating departments. Students will be introduced to practitioners in the field.

HISP 700 Final Seminar in Historic Preservation (3)
Critical evaluation of project, portfolio, or fieldwork on which the students have been working throughout the program; a synthesis of historic preservation process and achievements with special focus on careers in the field.

HIST – History

HIST 401 The Scientific Revolution: From Copernicus to Newton (3)
Major events in the history of physical science during the 16th and 17th centuries and their relation to philosophy, religion and society in Western Europe. The attack on ancient and medieval scientific theories; the transition from geocentric to heliocentric astronomy; discoveries of Kepler, Galileo and Newton; and the establishment of the "mechanical philosophy" that dominated early modern science.

HIST 402 The Development of Modern Physical Science: From Newton to Einstein (3)
Prerequisites: MATH 110; and PHYS 112 or PHYS 117 or equivalent. The history of physics in the 18th and 19th centuries, including some of its connections with mathematics, technology, chemistry and planetary science. Emphasis on internal technical developments in physical theory, with some discussion of experimental, philosophical and sociological aspects. This is the second part of a three-semester sequence (HIST 401, HIST 402, PHYS 490); each part may be taken independently of the others.

HIST 403 20th Century Revolutions in the Physical Sciences (3)
Prerequisites: MATH 110 or equivalent and six credits of college-level physics. Major changes in knowledge of the physical world, including quantum theory/atomic structure, relativity/cosmology, and continental drift/plate tectonics; theories about the nature of scientific revolutions.

HIST 404 History of Modern Biology (3)
The internal development of biology in the nineteenth and twentieth centuries, including evolution, cell theory, heredity and development, spontaneous generation, and mechanism - vitalism controversies. The philosophical aspects of the development of scientific knowledge and the interaction of biology with chemistry and physics.

HIST 406 History of Technology (3)
Not open to students who have completed HIST 407 prior to Fall Semester, 1989. The changing character of technology in modern history, beginning with the Middle Ages. Concentrates on the Industrial Revolution and its aftermath, the nature of technological knowledge and the sources of technological change.

HIST 407 Technology and Social Change in History (3)
Students with HIST 407 prior to Fall Semester 1989 must have permission of department to enroll in this course. Social consequences of technological innovations and the ways in which societies people have coped with new technologies.

HIST 409 Topics in the History of Science and Technology (3)
Repeatable to 6 credits if content differs. Selected topics in the history of science and technology.

HIST 410 Introduction to Archives I (3)
Prerequisite: permission of department. Corequisite: HIST 411. History of the basic intellectual problems relating to archives and manuscript repositories; emphasis on problems of selection, access, preservation, inventorying and editing as well as the variety of institutions housing documents.

HIST 411 Introduction to Archives II (3)
Prerequisite: permission of department. Corequisite: HIST 410. Practical experience through placement in cooperating archives or manuscript repositories in the Baltimore/Annapolis/Washington, D.C. areas. Assignments to specific projects based on intellectual interest of students.

HIST 412 Readings in Psycho-history (3)
Application of psychological theories to the study of historical personalities and collective behavior; survey of relevant personality theorists, and an evaluation of recent contributions.

HIST 413 History of Medicine and Public Health (3)
The history of medicine and public health from primitive times to the present, covering major medical theories, therapeutics, and techniques, the evolution of the medicine man or priest-physician into a professional medical practitioner, and the close relationship between medicine and society.

HIST 414 History of European Ideas I (3)
Review of the basic western intellectual traditions as a heritage from the ancient world. Selected important currents of thought from the scientific revolution of the 16th and 17th centuries down to the end of the 18th century.

HIST 415 History of European Ideas II (3)
A continuation of HIST 414 emphasizing 19th and 20th century thought.

HIST 418 Jews and Judaism: Selected Historical Topics (3)
Repeatable to 6 credits if content differs.

HIST 419 Special Topics in History (3)
Repeatable to 9 credits if content differs.

HIST 422 Byzantine Empire I (3)
The Eastern Roman Empire from Constantine the Great to the crisis of the ninth century. The development of the late Roman state into the Medieval Christian Byzantine empire and the evolution of a distinctive Byzantine culture.

HIST 423 Byzantine Empire II (3)
The Byzantine empire from the Macedonian renaissance to the conquest of Constantinople by the Turks in 1453: the Byzantine empire at its height, the crusades, Byzantium as a minor power, and its contributions to the Renaissance and the cultures of Russia and the Balkans.

HIST 424 History of Russia to 1801 (3)

HIST 425 History of Russia From 1801 - 1917 (3)
A continuation of HIST 424.

HIST 426 Age of Industry: Britain 1760 to 1914 (3)
An economic, social, political and cultural analysis of Britain in the age of its industrial supremacy. The nature of the first industrial revolution; the emergence of modern social classes; the cultural impact of industrialization; politics and society in the early and mid-nineteenth century; Victorianism and its critics; imperialism and politics; high and low culture; the rise of labor; social and political tensions 1910-1914.

HIST 427 Age of Decline: Britain 1914 to Present (3)
British society since the First World War. The social, cultural, economic and political impact of the First World War; labor and politics in the 1920s and 1930s; the inter-war depression, appeasement and foreign policy; the social impact of the Second World War; the welfare state and nationalization of industry; the dissolution of Empire; the emergence of a consumer society; social criticism in 1950s; the economic and political problems of the 1960s and 1970s.

HIST 430 Tudor England (3)
An examination of the political, religious and social forces in English life, 1485-1603, with special emphasis on Tudor government, the English reformation and the Elizabethan era.

HIST 431 Stuart England (3)
An examination of the political, religious and social forces in English life, 1603-1714, with special emphasis on Puritanism and the English revolutions.

HIST 432 Britain in the 18th Century (3)
Developments in Great Britain from the revolution of 1688 to the end of the Napoleonic wars.

HIST 435 Constitutional and Legal History of Britain (3)
Not open to students who have completed HIST 434 or HIST 435. Constitutional and legal developments in England from the Anglo-Saxon settlement to the present day. The rise and decline of monarchical government, the development of parliament, and the emergence of systematized, democratic government. The origins of the common law and legal profession, the development of a centralized judicial system, and the emergence of modern trial procedures. Survey knowledge of English history desirable.

HIST 436 French Revolution and Napoleon (3)
The causes and course of the French Revolution with emphasis on the struggle among elites, popular intervention, the spread of counterrevolution, the Terror as repression and popular government, the near collapse of the Republic, and the establishment and defeat of dictatorship.

HIST 437 Modern France from Napoleon to DeGaulle (3)
The changing political and cultural values of French society in response to recurrent crises throughout the 19th and 20th centuries. Students should have had some previous survey of either western civilization or European history.

HIST 440 Germany in the Nineteenth Century, 1815-1914 (3)
The development of modern Germany and the rise of national socialism.

HIST 441 Germany in the Twentieth Century, 1914-1945 (3)
Germany's aims and policies during World War I, its condition and policies in the inter-war period, the rise of national socialism, and Germany's part in World War II.

HIST 442 The Soviet Union (3)
A history of Soviet Russia and the Soviet Union from 1917 to the present. Stress on the relationship between Marxist theory and practice, and the development of peculiarly socialist institutions and practices.

HIST 443 Modern Balkan History (3)
A political, socio-economic, and cultural history of Yugoslav, Bulgaria, Romania, Greece, and Albania from the breakdown of Ottoman domination to the present. Emphasis is on movements for national liberation during the nineteenth century and on approaches to modernization in the twentieth century.

HIST 444 Nineteenth Century European Diplomatic History (3)
The development and execution of European diplomacy from the Congress of Vienna to the outbreak of World War I, concentrating on Central and Western Europe.

HIST 445 Twentieth Century European Diplomatic History (3)
The development and execution of European diplomacy from the outbreak of World War I to the conclusion of World War II, concentrating on Central and Western Europe.

HIST 446 European Economic History to 1750 (3)
Economic development of Europe from the manorial economy of medieval feudalism through the emergence of capitalist institutions and overseas empires to the advent of the industrial revolution.

HIST 447 European Economic History Since 1750 (3)
The mainsprings of the Industrial Revolution first in 18th century England and then across the rest of Europe during the 19th and 20th centuries. Emphasis on the English, French, German, Austro-Hungarian and Russian experiences with private capitalism and public policy, including fascism and communism. Social consequences of industrial development such as urbanization and the rise of labor movements.

HIST 450 Economic History of the United States to 1865 (3)
The development of the American economy from Columbus through the Civil War.

HIST 451 Economic History of the United States After 1865 (3)
The development of the American economy from the Civil War to the present.

HIST 452 Diplomatic History of the United States to 1914 (3)
American foreign relations from the American Revolution to the beginning of World War I. International developments and domestic influences that contribute to American expansion in world affairs. Analyses of significant individuals active in American diplomacy and foreign policy.

HIST 453 Diplomatic History of the United States from 1914 (3)
American foreign relations in the twentieth century. World War I, the Great Depression, World War II, the Cold War, the Korean War, and Vietnam. A continuation of HIST 452.

HIST 454 Constitutional History of the United States: From Colonial Origins to 1860 (3)
The interaction of government, law, and politics in the constitutional system. The nature and purpose of constitutions and constitutionalism; the relationship between the constitution and social forces and influences, the way in which constitutional principles, rules, ideas, and institutions affect events and are in turn affected by events. The origins of American politics and constitutionalism through the constitutional convention of 1787. Major constitutional problems such as the origins of judicial review, democratization of government, slavery in the territories and political system as a whole.

HIST 455 Constitutional History of the United States: Since 1860 (3)
American public law and government, with emphasis on the interaction of government, law, and politics. Emphasis on the political-constitutional system as a whole, rather than simply the development of constitutional law by the Supreme Court. Major crises in American government and politics such as Civil War, reconstruction, the 1890's, the New Deal era, the civil disorders of the 1960's.

HIST 456 History of Ideas in America to 1865 (3)
The ideas, conflicts, myths, and realities that shaped American character and society from the first settlements to the Civil War.

HIST 457 History of Ideas in America Since 1865 (3)
A continuation of HIST 456.

HIST 458 Selected Topics in Women's History (3)
Repeatable to 6 credits if content differs. Selected topics on women in American society including such areas as women and the law, women and politics, the "feminine mystique" and the "new feminism."

HIST 459 Society in America: Historical Topics (3)
Repeatable to 6 credits if content differs. A consideration of selected aspects of American society from colonial times to the present. Special emphasis on regionalism, immigration, nativism, minorities, urbanization, and social responses to technological changes.

HIST 460 History of Labor in the United States (3)
The American working class in terms of its composition; its myths and utopias; its social conditions; and its impact on American institutions.

HIST 461 Blacks in American Life: 1865 to Present (3)
The role of the Black in America since slavery, with emphasis on twentieth century developments: the migration from farm to city; the growth of the civil rights movement; the race question as a national problem.

HIST 462 The Civil War (3)
A detailed study of historical interpretations; the forces, situations and events that caused the war; the war and its impact.

HIST 463 History of the Old South (3)
The golden age of the Chesapeake, the institution of slavery, the frontier south, the antebellum plantation society, the development of regional identity and the experiment in independence.

HIST 465 History of the American Frontier: the Trans-Allegheny West (3)
Major historical interpretation of the significance to the period of the Trans-Allegheny West. Assesses the impact of the frontier experience on American history. Equal attention is given to political, economic, social and cultural problems associated with the development of the west. Indian culture, treatment of the Indians, and Indian-White relations are integrated into the course through readings and lectures.

HIST 467 History of Maryland (3)
Political, social and economic history of Maryland from the seventeenth century to the present.

HIST 470 Diplomatic History of Latin America (3)
A survey of the political, economic and cultural relations of the Latin American nations with emphasis on their relations with the United States and the development of the inter-American system.

HIST 471 History of Brazil (3)
The history of Brazil with emphasis on the national period.

HIST 472 History of the Argentine Republic (3)
Concentration upon the recent history of Argentina with emphasis upon the social and economic development of a third world nation.

HIST 473 History of the Spanish Caribbean (3)

HIST 474 History of Mexico and Central America I (3)
History of Mexico and Central America, beginning with the Pre-Spanish Indian cultures and continuing through European contact, conquest, and colonial dominance, down to the beginning of the Mexican War for Independence in 1810.

HIST 475 History of Mexico and Central America II (3)
A continuation of HIST 474 with emphasis on the political development of the Mexican nation.

HIST 477 American Foreign Relations in the Age of Roosevelt (3)
An intensive study of foreign relations from 1932 to 1945. Diplomacy in the Great Depression; rise and fall of American isolationism; "aid-short-of-war" in opposition to Axis aggression; FDR's conduct of foreign affairs during World War II; his guidance toward an expanded leadership role for the United States after the war; and beginnings of the Cold War with the Soviet Union.

HIST 480 History of Traditional China (3)
China from earliest times to 1644 A.D. Emphasis on the development of traditional Chinese culture, society, and government.

HIST 481 A History of Modern China (3)
Modern China from 1644 to the People's Republic of China. Emphasis on the coming of the west to China and the various stages of the Chinese reaction.

HIST 482 History of Japan to 1800 (3)
Traditional Japanese civilization from the age of Shinto mythology and introduction of continental learning down to the rule of military families, the transition to a money economy, and the creation of a townsmen's culture. A survey of political, economic, religious, and cultural history.

HIST 483 History of Japan Since 1800 (3)
Japan's renewed contact with the western world and emergence as a modern state, industrial society, and world power, 1800-1931; and Japan's road to war, occupation, and recovery, 1931 to the present.

HIST 485 History of Chinese Communism (3)
An analysis of the various factors in modern Chinese history that led to the victory of the Chinese communist party in 1949 and of the subsequent course of events of the People's Republic of China, from ca. 1919 to the present.

HIST 487 History of Soviet Foreign Relations, 1917 to Present (3)
A history of Soviet foreign relations both conventional diplomacy and the spread of international proletarianism from the October Revolution to the present.

HIST 491 History of the Ottoman Empire (3)
Survey of the Ottoman Turkish Empire from 1300 A.D. to its collapse during World War I. Emphasis on the empire's social and political institutions and its expansion into Europe, the Arab East and North Africa.

HIST 496 Africa Since Independence (3)
Analysis of socio-political and econo-political changes in Africa since approximately 1960; development of class structures, the role of the military, personal rule and the patrimonial state; decline of party politics and participatory politics. Discussion of changes in economic policies, policies with respect to rural communities, and their relationship to the state and decision-making.

HIST 497 Islam in Africa (3)
The introduction of Muslims and Islam into Africa from approximately the eighth to nineteenth century. Impact of Islam on a regional-cultural basis, as well as Islam in state development. A discussion of political theory in Islamic Africa, and the impact of Islam on social structures, e.g., domestic African slavery. Role of Islam in resistance movements against imperialism and colonization, as well as the place of Islam in the independence movements of the 1950's and 1960's.

HIST 499 Independent Study (1-3)
Prerequisite: permission of department. Repeatable to 6 credits.

HIST 600 Historiography (3)
Historical writing and critical analysis of selected interpretations and generalizations made by leading historians with examples from both European and United States history.

HIST 601 Methods in Historical Research (3)
Techniques of historical research and writing, emphasizing archival research, evaluation of sources, bibliography, and form and style in writing.

HIST 602 General Seminar: American History (3)
Classic and new interpretations of American history with special attention to current directions of scholarship and research.

HIST 603 General Seminar: European History (3)
Classic and new interpretations of European history with special attention to current directions of scholarship and research.

HIST 605 The Teaching of History in Institutions of Higher Learning (1)

HIST 606 Seminar in the History and Philosophy of Science and Technology (3)
Also offered as PHIL 650. Credit will be granted for only one of the following: HIST 606 or PHIL 650. Fundamental problems and current research in the history of science and technology; theories of historical change applied to selected cases in physical and biological science and in technology; historiographic and philosophical issues pertaining to these cases.

HIST 608 Occupational Internship (1-6)
Prerequisite: permission of department chairman. Repeatable to 6 credits. Individually arranged internship tailored to individual student needs with a cooperating public or private agency in the metropolitan, Washington/Baltimore area.

HIST 609 Readings in the History of Science and Technology (3)

HIST 618 Readings in the History of Women (3)

HIST 619 Special Topics in History (1-3)

HIST 628 Readings in Colonial American History (3)

HIST 629 Readings in the American Revolution and the Formative Period (3)

HIST 638 Readings in the Middle Period and Civil War (3)

HIST 639 Readings in Reconstruction and the New Nation (3)

HIST 648 Readings in Recent American History (3)

HIST 658 Readings in American Constitutional History (3)

HIST 659 Readings in American Cultural and Intellectual History (3)

HIST 668 Readings in American Social History (3)

HIST 669 Readings in the Economic History of the United States (3)
Repeatable to 6 credits. An examination of the major issues in the history of the economy of the United States from the 17th century to the present, as these have been discussed by the more important economic historians.

HIST 678 Readings in American Labor History (3)
Social and cultural history of the American working class with special attention to communities based on ethnicity, race, sex, residence and ideology; history of the labor movement; selected comparisons with working-class communities of other countries.

HIST 679 Readings in the History of American Foreign Policy (3)

HIST 689 Readings in Southern History (3)

HIST 698 Readings in the History of the American Frontier (3)
Repeatable to 6 credits if content differs. The American frontier experience 1763-1890. Equal emphasis on the Trans-Appalachian and Trans-Mississippi West.

HIST 718 Readings in Medieval History (3)

HIST 719 Readings in the History of the Renaissance and Reformation (3)

HIST 728 Readings in Early Modern European History (3)

HIST 729 Readings in Modern European History (3)
Reading knowledge of some European language recommended but not required.

HIST 739 Readings in the History of Great Britain (3)

HIST 748 Readings in Modern French History (3)

HIST 749 Readings in German History, 1815 to the Present (3)
Repeatable to 9 credits if content differs. Reading knowledge of German is encouraged, but not required.

HIST 758 Readings in Eastern European History (3)
Repeatable to 6 credits if content differs. Selected topics in the history of the Hapsburg monarchy and the successor states, Poland and the Balkans. Emphasis on the rise of nationalism during the 19th century and the experience with fascism and communism in the 20th century.

HIST 759 Readings in Russian and Soviet History (3)

HIST 768 Readings in Chinese History (3)

HIST 769 Readings in Japanese History (3)

HIST 778 Readings in Latin American History (3)

HIST 779 Readings in Middle Eastern History (3)

HIST 788 Readings in European Economic and Labor History (3)
Selected topics in European economic history from 1648 to the second World War. Attention to the mainsprings of industrialization, the economic consequences of war and revolution, and

the variety of European labor movements. An introduction to the use of quantitative methods is provided.

HIST 789 Readings in Modern European Intellectual History (3)

HIST 798 Readings in Jewish History (3)
Repeatable to 6 credits. Readings on selected topics in Jewish history. Emphasis on analysis of primary sources. Reading knowledge of Hebrew recommended.

HIST 799 Master's Thesis Research (1-6)

HIST 808 Seminar in the History of Science and Technology (3)
Prerequisite: HIST 609 or permission of instructor.

HIST 809 Seminar in the History of Women (3)

HIST 818 Seminar in Historical Editing (3)
Repeatable to 6 credits. An apprenticeship in the editing of documentary sources and scholarly articles for publication.

HIST 820 Seminar in Chinese History (3)

HIST 821 Seminar in Japanese History (3)

HIST 828 Seminar in Middle Eastern History (3)

HIST 829 Seminar in Latin American History (3)

HIST 838 Seminar in Ancient History (3)
Prerequisite: permission of instructor. Repeatable to 6 credits.

HIST 839 Seminar in Medieval and Early Modern European History (3)

HIST 840 Seminar in Greek History (3)

HIST 841 Seminar in Roman History (3)

HIST 844 Seminar in the History of the Renaissance and Reformation (3)

HIST 848 Seminar in Modern European History (3)

HIST 849 Seminar in Russian and Soviet History (3)

HIST 850 Seminar in East European History (3)
Research papers on the history of the lands which are now Austria, Hungary, Czechoslovakia, Poland and the Balkan states, from the 18th century to the present.

HIST 851 Seminar in German History (3)
Prerequisite: HIST 749 or permission of instructor. Reading knowledge of German is required.

HIST 852 Seminar in Modern French History (3)

HIST 853 Seminar in Nineteenth Century Europe (3)

HIST 854 Seminar in 20Th Century European History (3)
Prerequisite: HIST 729 or permission of instructor. Seminar in 20th century European history, 1914 to present.

HIST 855 Seminar in Modern European Intellectual History (3)

HIST 856 Seminar in Modern European Diplomatic History (3)
Prerequisite: reading ability of either French or German. A course in modern European history.

HIST 857 Seminar in the Social and Cultural History of Europe (3)
Research methods for multi-generational family history, the comparative study of folk cultures, and the study of creative minorities. Includes a general introduction to research in European society and culture.

HIST 858 Seminar in the History of Great Britain (3)

HIST 859 Seminar in History of Modern Wars (3)

HIST 860 Seminar in Tudor and Stuart England (3)

HIST 861 Seminar in English Law and Government, 1550-1760 (3)
Prerequisite: HIST 430 or HIST 431 or HIST 432 or HIST 435 or permission of instructor. From the accession of Elizabeth I to the death of George II.

HIST 878 Seminar in Colonial American History (3)

HIST 879 Seminar in the American Revolution and Formative Period (3)

HIST 880 Seminar in Southern History (3)

HIST 881 Seminar in American Frontier History (3)
A research-writing seminar dealing with selected topics related to the American frontier, especially the Trans-Appalachian and Trans-Missippippi west, 1774 to the 20th century.

HIST 882 Seminar in the History of Maryland (3)

HIST 888 Seminar in the Middle Period and Civil War (3)

HIST 889 Seminar in Reconstruction and the New Nation (3)

HIST 890 Seminar in American Intellectual History (3)

HIST 892 Seminar in American Social History (3)

HIST 893 Seminar in the Economic History of the United States (3)
A research-writing seminar dealing with selected topics in American economic development from the colonial period to the present.

HIST 894 Seminar in American Labor History (3)
Advanced research and writing on selected topics in the history of American workers, their conditions, communities, organizations and ideas.

HIST 895 Seminar in American Constitutional History (3)

HIST 896 Seminar in the History of American Foreign Policy (3)

HIST 898 Seminar in Recent American History (3)

HIST 899 Doctoral Dissertation Research (1-8)

HLTH – Health

HLTH 420 Methods and Materials in Health Education (3)
Prerequisites: HLTH 105 or HLTH 140. The purpose of this course is to present the interrelationships of curriculum planning, methodology and the selection and use of teaching aids and materials. Special problems associated with health teaching are discussed. Students become familiar with a variety of resources as well as planning for and presenting demonstration lessons.

HLTH 430 Health Education in the Workplace (3)
A survey of the role of health education in work settings. Examination of occupational stress, the health effects of shift work, women's health in the workplace, health education approaches to informing workers and management, and health promotion programs in the workplace.

HLTH 440 Health Education and Behavioral Approaches to Nutrition (3)
Prerequisite: NUTR 100 or equivalent. Health education and health behavior methods, techniques and approaches applied to nutrition behavior, ways of changing nutrition and dietary behavior, relationship between nutrition and health, nutrition education, psychology of eating, and behavioral and cultural factors in diet.

HLTH 450 Health of Children and Youth (3)
A study of the health of 5 to 18 year olds. Physical, mental, social, and emotional health. Psychosexual development, diet, exercise, recreation, and the roles of parents and teachers.

HLTH 455 Physical Fitness of the Individual (3)
Study of major physical fitness problems confronting the adult in modern society. Consideration given to the scientific appraisal, development and maintenance of fitness at all age levels. Obesity, weight reduction, chronic fatigue, posture, and special exercise programs are explored. Open to persons outside the physical education and health fields.

HLTH 456 Health of the Aging and Aged (3)
Psychological, physiological and socio-economic aspects of aging; nutrition; sexuality; death, dying, and bereavement; self-actualization and creativity; health needs and crises of the aged.

HLTH 465 Safety Program Evaluation (3)
Prerequisite: HLTH 370 or permission of department. Methods and techniques used to evaluate safety programs with special reference to managerial decisionmaking, needs assessment and hazard recognition, evaluation and control.

HLTH 470 The Health Program in the Elementary School (3)
Prerequisites: HLTH 105 or HLTH 140; and HLTH 310. Designed for the elementary school classroom teacher. Analyzes biological and sociological factors which determine the health status and needs of the individual elementary school child. Various aspects of the school program are evaluated for their role in health education. The total school health program is surveyed from the standpoint of organization and administration, and health appraisal. Emphasis is placed upon modern methods and current materials in health instruction. (The state department of education accepts this course for biological science credit).

HLTH 471 Women's Health (3)
The women's health movement from the perspective of consumerism and feminism. The physician-patient relationship in the gynecological and other medical settings. The gynecological exam, gynecological problems, contraception, abortion, pregnancy, breast and cervical cancer and surgical procedures. Psychological aspects of gynecological concerns.

HLTH 476 Death Education (3)
Examination of the genesis and development of present day death attitudes and behavior by use of a multidisciplinary life cycle approach.

HLTH 480 Measurement in Health (3)
Two hours of lecture and two hours of laboratory per week. The application of the principles and techniques of educational measurement to the teaching of health and physical education; study of functions and techniques of measurements in the evaluation of student progress toward the objectives of health and physical education, and in the evaluation of the effectiveness of teaching.

HLTH 487 Adult Health and Developmental Program (3)
Training and experience in a clinically oriented development program for the aged.

HLTH 489 Field Laboratory Projects and Workshop (1-6)
Note: the maximum total number of credits that may be earned toward any degree in kinesiology, recreation, or health education under KNES, RECR, or HLTH 489 is six. A course designed to meet the needs of persons in the field with respect to workshop and research projects in special areas of knowledge not covered by regularly structured courses.

HLTH 490 Theories of Children's Love and Peace Behavior (3)
The development of love and peace behaviors as health correlates in infra human and human species from infancy through childhood with special emphasis upon the role of physical education, recreation, and health. The examination of existing models in the areas of family, school, and clinical settings.

HLTH 498 Special Topics in Health (3)
Prerequisite: permission of department. Repeatable to 3 credits if content differs. Topics of special interest in areas not covered by regularly scheduled courses.

HLTH 600 Seminar in Health (1)

HLTH 650 Health Problems in Guidance (3)

HLTH 651 Seminar On the Health Correlates of the Aging and Aged (3)
Investigates the most recent theoretical formulations, research data, and clinical and therapeutic approaches to improving the health status of the aging. Extensive readings and research project are required.

HLTH 652 Seminar in Death Education (3)
Prerequisite: HLTH 456 or permission of department. The advanced study and investigation of human dying, death, bereavement, suicidal behavior, and their relationship to human health utilizing a multidisciplinary approach.

HLTH 665 Health Behavior I (3)
The psychological, social psychological, and sociological theories of health behavior. The relation of health knowledge, beliefs, attitudes, intentions, and behavior to preventive, illness, sick-role, and health utilization behaviors.

HLTH 666 Health Behavior II (3)
Prerequisite: HLTH 665. An advanced course with intensive training in health behavior research and the opportunity to carry out original research in health behavior. Patient-provider interaction, patient cooperation with medical treatment and other social and psychological influences on health care.

HLTH 670 Status and Trends in Health Education (3)

HLTH 680 The Dynamics of Coping with Stress (3)
Prerequisite: HLTH 285 or permission of department. Opportunity for health educators to explore the interaction of psychological, physiological, and behavioral responses to stressful environments. Intended for health education programs in interdisciplinary settings.

HLTH 687 Advanced Seminar (1-3)

HLTH 688 Special Problems in Health Education (1-6)

HLTH 710 Methods and Techniques of Research (3)

HLTH 711 Advanced Research Methods in Health (3)
Prerequisite: HLTH 710. Quantitative techniques, advanced research methods and design issues.

HLTH 720 Scientific Foundations of Health Education (3)

HLTH 730 Problems in Weight Control (3)
Prerequisite: HLTH 720 or permission of department. A study of the causes, health cost, and control of obesity through analysis of lipid-glucose interaction; hunger-satiety theories and mechanisms; psycho-social forces in obesity; body composition, energy output; and disease states related to obesity.

HLTH 740 Modern Theories of Health (3)

HLTH 750 Stress and Disease (3)
A study of the causative agents of chronic disease with particular emphasis on stress including the physiological response of the human organism to contemporary psycho-social stressors and mechanisms of adaptation and prophylaxis.

HLTH 760 Public Health (3)

HLTH 775 Health Education Program Planning and Evaluation (3)
Prerequisites: HLTH 710 and permission of department. A systematic approach to the planning and evaluation of Health Education programs. Diagnosis of the social, psychological, educational and administrative aspects of the health education program. Program monitoring, rigorous methods of impact assessment, and the measurement of efficiency.

HLTH 780 Applied Principles of Health Education (3)
Prerequisite: HLTH 665 or permission of department. An application of psychosocial theory related to health behavior. The use of theoretical frameworks in developing group or individual instructional designs to affect psychosocial variables which impact upon health behavior.

HLTH 785 Internship in Health Education (3)
Prerequisites: [HLTH 665; and HLTH 775; and HLTH 780]; or permission of department. The application of previously acquired skills and knowledge to the planning, conduct, and evaluation of health education. Emphasis on education designed to affect and use psychosocial influences of health behavior. The setting of the internship will depend upon the student's background and career goals.

HLTH 791 Curriculum Construction in Health Education (3)

HLTH 799 Master's Thesis Research (1-6)

HLTH 899 Doctoral Dissertation Research (1-8)

HORT – Horticulture

HORT 432 Greenhouse Crop Production (3)
Prerequisite: HORT 201; and HORT 202. Pre- or corequisite: BOTN 441. The commercial production and marketing of ornamental plant crops under greenhouse, plastic houses and out-of-door conditions.

HORT 433 Technology of Fruit and Vegetable Production (4)
Three hours of lecture and three hours of laboratory per week. *Prerequisite: HORT 201; and HORT 202; and HORT 271; and AGRO 411. Corequisite: HORT 271 and BOTN 441.* Recommended: AGRO 302. 60 semester hours. Junior standing. Credit will be granted for only one of the following: HORT 411, HORT 422, or HORT 433. A critical analysis of research work and application of the principles of plant physiology, chemistry and botany to practical problems in the commercial production of fruit and vegetable crops.

HORT 452 Principles of Landscape Establishment and Maintenance (3)
Two hours of lecture and two hours of laboratory per week. *Prerequisite: HORT 201; and HORT 202; and HORT 453 or HORT 454.* A study of the establishment and maintenance of woody plants stressing the physiological determinants of recommended practices. Topics covered will include site preparation, transplanting, staking, mulching, pruning, fertilizing and related topics.

HORT 453 Woody Plant Materials I (3)
Prerequisite: BOTN 212. A field and laboratory study of trees, shrubs, and vines used in ornamental plantings. Major emphasis is placed on native deciduous plant materials.

HORT 454 Woody Plant Materials II (3)
Prerequisite: BOTN 212. A field and laboratory study of trees, shrubs, and vines used in ornamental plantings. Major emphasis is placed on introduced and evergreen plant materials.

HORT 456 Nursery Crop Production (3)
Two lectures a week and four all-day compulsory Saturday laboratories. *Pre- or corequisites: HORT 201; and HORT 202; and HORT 271.* The methods used for producing ornamental plants and an introduction to the different types of commercial nurseries.

HORT 462 Urban Landscape Design (4)
Three hour lecture and one two-hour studio per week. *Prerequisite: HORT 361 and either HORT 453 or HORT 454. Corequisite: HORT 452.* Trends in the field of urban landscape design. Explore the two distinct areas of planting design and urban design and focus on the efforts to integrate them within the spectrum of landscape architectural studies.

HORT 464 Principles of Landscape Construction (3)
One lecture and two two-hour studio periods per week. *Prerequisite: HORT 361.* Landscape development principles and construction practices as applied to grading, drainage, layout, and vehicular and pedestrian circulation.

HORT 465 Landscape Structures and Materials (3)
One lecture and two two-hour studio periods per week. *Prerequisite: HORT 464.* Use and design of structures in the landscape.

HORT 466 Advanced Landscape Design (3)
One lecture and two studio periods per week. *Prerequisites: HORT 462; and HORT 465; and HORT 452.* A synthesis of design, landscape development, construction and planting principles and procedures as applied to the comprehensive design of public and private landscapes.

HORT 467 Landscape Contracting and Professional Practice (3)
Prerequisites: (AREC 306 or AREC 414); and HORT 452. Introduction to and comparative study of the business concerns of landscape contracting companies and landscape architectural firms. The legal, financial, marketing, and personnel management practices in both business realms.

HORT 472 Advanced Plant Propagation (2)
Prerequisite: HORT 201; and HORT 202; and HORT 271. A study of the anatomy, morphology and physiology of the seed and plant as related to macro and micro forms of propagation. A review of research in propagation.

HORT 474 Physiology of Maturation and Storage of Horticultural Crops (3)
Two hours of lecture and two hours of laboratory per week. *Pre- or corequisite: BOTN 441.* The physiological and biochemical changes occuring during storage of horticultural commodities. Application of scientific principles to handling and storage of fresh produce.

HORT 489 Special Topics in Horticulture (1-3)
Credit according to time scheduled and organization of course. A lecture and/or laboratory series organized to study in depth a selected phase of horticulture not covered by existing courses.

HORT 682 Methods of Horticultural Research (3)
One hour of lecture and four hours of laboratory per week. The application of biochemical and biophysical methods to problems in biological research with emphasis on plant materials.

HORT 683 Light and Plant Development (3)
Prerequisite: BOTN 441 or permission of instructor. Recommended: PHYS 263, PHYS 406, BOTN 484. Photobiology including: photochemistry, photosynthesis and photomorphogenesis. How light (UV, visible and near infrared) interacts with plants to regulate physiological responses such as stomatal function, carbon fixation, phototropism and flowering.

HORT 689 Special Topics in Horticulture (1-3)
Credit according to time scheduled and organization of the course. Organized as a lecture series on a specialized advanced topic.

HORT 699 Special Problems in Horticulture (1-3)
Credit according to time scheduled and organization of the course. Organized as an experimental program other than the student's thesis problem. Maximum credit allowed toward an advanced degree shall not exceed four hours of experimental work.

HORT 781 Edaphic Factors and Horticultural Plants (3)
Prerequisite: BOTN 441. A critical study of scientific literature and current research concerning factors of the soil affecting production of horticultural plants. Selected papers are studied and critically discussed. Attention is given to experimental procedures, results obtained, interpretation of the data, and to evaluation of the contribution.

HORT 782 Chemical Regulation of Growth of Horticultural Plants (3)
Prerequisite: BOTN 441. A critical review of literature and current research relating to the use of chemicals in controlling growth, and useful in the production, ripening, and handling of horticultural plants and products. Emphasis is placed on experimental procedures and the interpretation of results, current usage and the potentials for future research.

HORT 783 Environmental Factors and Horticultural Plants (3)
Prerequisite: BOTN 441. A study of the literature and a discussion of current research concerned with the effects of environmental factors on the growth and fruiting of horticultural plants. Effects of temperature, light, and atmospheric conditions will be considered.

HORT 784 Current Advances in Plant Breeding (3)
Prerequisite: HORT 274 or equivalent or permission of instructor. Studies of the genetic and cytogenetic basis of plant breeding, systems of pollination control and their application, mutation breeding, methods of breeding for resistance to plant diseases and environmental pollutants.

HORT 785 Advanced Post-Harvest Physiology (3)
Prerequisites: (BCHM 461, and HORT 474); or permission of department. Physiological, biochemical and molecular aspects of senescence of detached plant organs, such as fruits, leaves and flowers.

HORT 798 Advanced Seminar (1)
Repeatable to a maximum of 3 credits for M.S. degree. Repeatable to a maximum of 6 credits for Ph.D. degree.

HORT 799 Master's Thesis Research (1-6)

HORT 899 Doctoral Dissertation Research (1-8)

HSAD – Housing and Design

HSAD 440 Interior Design III (4)
Prerequisite: HSAD 344. For interior design majors only. Eight hours studio periods. Preparation of complete presentation: work specifications, floor plans, purchase orders, renderings, etc. Portfolio preparation.

HSAD 441 Interior Design IV (4)
Prerequisite: HSAD 440. For interior design majors only. Eight hours studio periods. Preparation of complete presentation: work specifications, floor plans, purchase orders, renderings, etc. Portfolio preparation.

HSAD 442 Barrier-free Interiors I (3)
Prerequisite: APDS 101A or equivalent and consent of instructor. An introduction to determinants of design decisions in relation to the handicapped, aging and disabled: physical limitations and design support systems.

HSAD 443 Barrier-free Interiors II (3)
Prerequisites: HSAD 343, HSAD 442. Three studio periods. Experience in solving problems related to interior space, both individual and congregate, and its use by the handicapped, aging and disabled.

HSAD 451 Gaming Simulation in Design I (3)
Prerequisite: Two upper-division level courses in HSAD, FMCD, ARCH, URBS, GVPT or permission of department. Simulation games as a means to model social interaction. Applications in the fields of urban, architectural, interior and graphic design; planning; housing; and community development. Mathematical gaming theory as it relates to simulation games.

HSAD 452 Gaming Simulation in Design II (3)
Prerequisite: HSAD 451. The design and testing of student-developed simulation games in the fields of urban, architectural, interior and graphic design; planning; housing; and community development.

HSAD 460 Housing Costs and Financing (3)
Prerequisite: MATH 110 and ECON 205 or equivalent. Effects of housing costs and financing on the ability of households to obtain satisfactory housing. Influence of public and private groups on the cost of housing and availability of financing. Basic quantitative techniques of housing cost analysis.

HSAD 462 Seminar on Ideas in Design (3)
Pre- or corequisite: HSAD 362 or permission of deptartment. Detailed examination and discussion of concepts presented in HSAD 362.

HSAD 488 Selected Topics in Housing and Interior Design (1-6)
Offered on demand. May be repeated to a maximum of six hours if content differs.

HSAD 499 Individual Study in Housing and/or Interior Design (3-4)
Guidance for the advanced student capable of independent subject matter investigation or creative work. Problem chosen with consent of instructor.

HSAD 658 Special Topics in Housing and Interior Design (3-6)
Individual study or arranged group study. May be repeated to a maximum of six hours if content differs.

ITAL – Italian

ITAL 411 Dante - in Translation (3)
Credit will be granted for only one of the following: ITAL 411 or ITAL 412. Dante's thought as expressed in his major writings: The Vita Nuova, De Monarchia and The Divine Comedy. In English.

ITAL 412 Dante - in Italian (3)
Credit will be granted for only one of the following: ITAL 411 or ITAL 412. Dante's thought as expressed in his major writings: The Vita Nuova, De Monarchia and The Divine Comedy. In Italian.

ITAL 421 The Italian Renaissance (3)
Credit will be granted for only one of the following: ITAL 421 or ITAL 422. Formerly ITAL 410. Major trends in Renaissance literature, art, and science. In English.

ITAL 422 The Italian Renaissance - in Italian (3)
Credit will be granted for only one of the following: ITAL 421 or ITAL 422. A study of major trends of thought in Renaissance literature, art, and science. In Italian.

ITAL 470 Italian Civilization - in Italian (3)
Credit will be granted for only one of the following: ITAL 470 or ITAL 370. Political, social, intellectual, literary and artistic forces shaping contemporary Italy, from the late Middle Ages to the present. In Italian.

ITAL 471 Italian Cinema: A Cultural Approach (3)
Credit will be granted for only one of the following: ITAL 471 or ITAL 472. Formerly ITAL 475. The culture of Italy through the medium of film from the silent days up to the present. In English.

ITAL 472 Italian Cinema: A Cultural Approach - in Italian (3)
Credit will be granted for only one of the following: ITAL 471 or ITAL 472. The culture of Italy through the medium of film from the silent days up to the present. In Italian.

ITAL 476 The Italian Opera Libretto - in Italian (3)
Credit will be granted for only one of the following: ITAL 476 or ITAL 376. History and analysis of Italian opera librettos from Monteverdi through Mozart to Verdi and Puccini. In Italian.

ITAL 498 Special Topics in Italian Literature (3)
Repeatable to 6 credits if content differs.

ITAL 499 Special Topics in Italian Studies (3)
Repeatable to 6 credits if content differs.

JAPN – Japanese

JAPN 401 Readings in Modern Japanese I (3)
Prerequisite: JAPN 302 or equivalent. Development of translation techniques, vocabulary, grammar, and reading speed. Readings in history, social sciences, modern literature, and modern newspaper and periodical literature.

JAPN 402 Readings in Modern Japanese II (3)
Prerequisite: JAPN 401 or equivalent. Continuation of more advanced readings.

JAPN 403 Readings in Classical Japanese (3)
Prerequisite: JAPN 302 or equivalent. Classical Japanese grammar and the varied styles of classical Japanese. Readings in classical texts drawn from the Heian, Kamakura, Muromachi, and Edo periods.

JAPN 414 Masterpieces of Classical Japanese Literature in Translation (3)
Major classics, with focus on philosophical, historical and cultural backgrounds.

JAPN 415 Modern Japanese Fiction in Translation (3)
Major themes and literary developments in fiction from the late 19th century to the present. Emphasis on the works of Kawabata, Tanizaki, Mishima, and Abe.

JAPN 418 Japanese Literature in Translation (3)
Repeatable to 9 credits if content differs. Representative works of Japanese literature in translation.

JAPN 421 History of the Japanese Language (3)
Investigation of the origin of the Japanese language, its relationship with other languages, and its development. In English.

JAPN 422 Introductory Japanese Linguistics (3)
An investigation of Japanese sound patterns and syntax through a comparison with English.

JAPN 499 Directed Study in Japanese (1-3)
Prerequisite: permission of instructor. Repeatable to 6 credits if content differs.

JOUR – Journalism

JOUR 400 Law of Mass Communication (3)
Legal rights and constraints of mass media; libel, privacy, copyright, monopoly, contempt, and other aspects of the law applied to mass communication. Previous study of the law not required.

JOUR 410 History of Mass Communication (3)
Development of newspapers, magazines, radio, television and motion pictures as media of mass communication. Analysis of the influences of the media on the historical development of America.

JOUR 420 Government and Mass Communication (3)
Relationship between news media and government; media coverage of government and politics; governmental and political information and persuasion techniques.

JOUR 430 Comparative Mass Communication Systems (3)
Comparative analysis of the role of the press in different societies.

JOUR 440 Readings in Journalism Literature (3)
Prerequisite: JOUR 320 or permission of department. Analysis of books by journalists highly regarded for writing style and/or the content of their reporting with an emphasis on understanding the books in the context of national and international affairs.

JOUR 450 Mass Media in Society (3)
Ethical, moral, political, economic, and social consideration of mass communication.

JOUR 451 Advertising and Society (3)
Advertising as an institution with manifest economic purposes and latent social effects. Influences of advertising on people, and related issues of ethics and social responsibility.

JOUR 452 Women in the Media (3)
Participation and portrayal of women in the mass media from colonial to contemporary times.

JOUR 459 Special Topics in Mass Communication (3)
Repeatable to 6 credits if content differs. Issues of special concern and current interest. Open to all students.

JOUR 461 Newspaper Management (3)
Organization, operation, and administration of the departments of a newspaper: advertising, business-finance, circulation, news-editorial, personnel, production, and promotion.

JOUR 471 Public Opinion Research (3)
Measurement of public opinion and media habits; role of the mass media in the formation of public opinion.

JOUR 477 Mass Communication Research (3)
Prerequisite: MATH 110 or equivalent; students are encouraged to have completed the theory and technique courses in their major sequence. Communication research methods used in measuring public opinion and evaluating public relations, advertising, and mass media programs and materials.

JOUR 481 Writing the Complex Story (3)
Pre- or corequisite: JOUR 371. Explanatory journalism technique applied to complex subjects (such as science, economics and large scale social change) for books, magazines and newspaper series.

JOUR 483 Senior Seminar in Public Relations (3)
Prerequisite: JOUR 331; and JOUR 477. Integration of theory, techniques and research methods into the planning and execution of public relations campaigns for specific organizations. Analysis of research on the case studies of public relations.

JOUR 484 Advertising Campaigns (3)
Prerequisite: JOUR 341; and JOUR 342. Planning and executing advertising campaigns in actual agency situations. Integration of advertising theories and techniques into a complete campaign.

JOUR 486 Advanced Television Journalism (3)
Prerequisite: JOUR 361 or permission of department. A skills course in which students assume major responsibility for the production of a weekly TV news and public affairs program. Students will work on extended TV reporting assignments such as mini-series and news documentaries. Note: In addition to classroom time, students are required to devote time out of class in reporting and editing.

JOUR 487 Literary Journalism (3)
Pre- or corequisite: JOUR 371. Practice in the use of literary techniques and especially of dramatic structure in modern newspaper series, magazine pieces and books. Analysis, researching and writing of nonfiction stories, usually with a focus on a specialized area chosen by the student.

JOUR 490 Advising Student Publications (3)
Journalistic writing and editing in student newspapers, yearbooks, and magazines; libel and policy; curriculum and teaching procedures; role of student publications.

JOUR 491 Policy, Censorship, and Legal Problems of Student Publications (3)
Censorship problems and court cases; legal rights of the student press; formulation of policy and legal guidelines.

JOUR 492 Typography and Layout For Student Publications (3)
Type design, type families, graphics, art, photography, and editorial and advertisement layout of school newspapers, yearbooks, and magazines.

JOUR 493 Advanced Techniques For Student Publication Advisors (3)
Interpretative and investigative reporting; interviewing and scientific survey methods; curriculum and courses for high school and community colleges; textbooks, teaching units, state of the art techniques and resource aids.

JOUR 494 Yearbook Short Course (1)
Prerequisite: JOUR 201 or permission of department. Credit not applicable toward major in journalism. Intensive course dealing with the theme, content, copy, design, advertising, budget, finance, law and ethics of yearbook development and production.

JOUR 498 Topics in Scholastic Journalism (1-3)
Repeatable if content differs. Seminars on specialized areas on the practice of scholastic journalism.

JOUR 501 Writing and Editing Reviews (3)
Review of writing and editing techniques for graduate students. Principles of news, feature and publicity writing for mass media, as well as editing and graphic concepts appropriate for newspapers and magazines. Not applicable for degree credit.

JOUR 600 Research Methods in Mass Communication (3)

JOUR 601 Theories of Mass Communication (3)

JOUR 610 Seminar in Mass Media and Society (3)
Analysis and discussion of the interrelationships between the mass media and society, including various social and cultural elements of modern society; responsibilities of the mass media and the mass communicator.

JOUR 620 Seminar in Public Affairs Reporting (3)
Prerequisite: JOUR 320.

JOUR 621 Interpretation of Contemporary Affairs (3)
Prerequisite: JOUR 320.

JOUR 630 Seminar in Public Relations Management (3)
Relationship of public relations management to organizational structure and communication functions. Objectives, planning, staffing, budgeting, administering, and evaluation of public relations programs.

JOUR 631 Seminar in Public Relations Publics (3)
Analysis of public relations programs aimed at organizational publics. Media, issue-related, community, employee, governmental, consumer, financial, and student/educator publics. Theories of the nature of publics, communication behavior of publics, and effects of public relations programs aimed at different publics.

JOUR 632 Research Design in Public Relations (3)
Application of the philosophical, sociological and political principles to research design in public relations.

JOUR 640 Mass Culture and Mass Communication (3)

JOUR 680 Science Communication (3)
Advanced professional training in science reporting and writing for the mass media and in technical communication to specialized audiences. Communication behaviors of scientists and audiences. Application of communication theory and the history and philosophy of science to science writing.

JOUR 698 Special Problems in Communication (3)
Repeatable to 6 credits. Independent study in area of student's interest.

JOUR 700 Seminar in Mass Media Law (3)

JOUR 710 Seminar in Mass Media History (3)

JOUR 720 Seminar in Government and Mass Communication (3)

JOUR 721 Seminar in Urban Mass Communication (3)

JOUR 728 Topics in Public Affairs Reporting (3)
Prerequisite: JOUR 620.

JOUR 730 Seminar in Comparative Mass Communication (3)

JOUR 731 Cross-Cultural Communication (3)

JOUR 738 Topics in International and Cross-Cultural Communication (3)
Repeatable to 6 credits if content differs. Specialized topics in the fields of comparative journalism and mass communications and in the field of cross-cultural communication.

JOUR 739 Topics in Public Relations (3)
Prerequisite: JOUR 630. Repeatable to 6 credits if content differs. Seminar on specialized areas of scholarly research in public relations or on the practice of public relations in specialized organizational settings.

JOUR 740 Seminar in Advertising Communication (3)
Role of advertising as a form of public communication in American society. Advertising and the firm; advertising and the economy; advertising and the individual; advertising and consumerism; advertising and the media.

JOUR 750 Seminar in Mass Media Analysis (3)
Appraisal of mass media practices from several points of view, including ethics, personal values, and societal values.

JOUR 760 Seminar in Broadcast News (3)
Descriptive and critical analysis of broadcast news; methods of evaluation of news judgments; decision-making and organizational aspects of the broadcast news industry.

JOUR 768 Topics in Broadcasting and Electronic Media (3)
Prerequisite: JOUR 760. Repeatable to 6 credits if content differs. Advanced research and analysis of selected topics in broadcast journalism and new communication technologies.

JOUR 780 Seminar in Research Problems (3)
Prerequisite: JOUR 600. Methods of research design and analysis in specialized areas of mass communication research.

JOUR 798 Masters Professional Fieldwork (2-6)
Repeatable to 6 credits. Research for and preparation of news articles or programs for use in the mass media; or in development of public relations; or in advertising programs for actual organizations. Analysis of fieldwork experience using communication theory and research results. Fieldwork may be done independently or as an internship.

JOUR 799 Master's Thesis Research (1-6)

JOUR 818 Seminar in Communication Theories (3)
Repeatable to 9 credits if content differs.

KNES – Kinesiology

KNES 402 Biomechanics of Sport (3)
Prerequisite: KNES 300. Formerly PHED 402. Mechanical determinants influencing sport techniques. A quantitative, scientific basis for sport analysis with emphasis on the application to numerous sport activities. Evaluation and quantification of the filmed performance of athletes.

KNES 406 Perceptual-Motor Development in the Young Child (3)
Formerly PHED 406. Analysis of perceptual-motor components, their progression, interrelationshi ps, developmental activities and evaluation. Study of the growth and other factors that influence perceptual-motor development in the young child.

KNES 421 Elementary School Physical Education: A Movement Approach (3)
Prerequisite: KNES 183. Formerly PHED 421. An analysis of movement philosophy and content, focusing upon cognitive, psychomotor and affective developmental characteristics in relation to progression and planning of games, educational dance and educational gymnastics for elementary school age children.

KNES 450 Sport Psychology: Applications (3)
Two hours of lecture and two hours of laboratory per week. *Prerequisite: KNES 350. Formerly PHED 450.* Application of the principles of sport psychology to the competitive or recreational athlete, with an emphasis on the techniques that have been used with competitors to maximize skill acquisition and performance.

KNES 451 Sport and the American Woman (3)
Formerly PHED 451. The expanding perception of the woman's role in American society; etiology of sex differences; socialization of sex roles in America; development of "masculinity" and "feminity" in children through early play experiences; competition and women; personality of the female athlete; and personal motivations of female athletes and projected future for sport and the American.

KNES 455 Scientific Bases of Athletic Conditioning (3)
Prerequisite: KNES 360. Formerly PHED 455. An examination of physical fitness/athletic conditioning programs stressing the practical application of exercise physiology theory for enhancing athletic performance. Cardiovascular considerations, strength and power development, nutrition, speed, muscular endurance, environmental considerations and ergogenic aids.

KNES 461 Exercise and Body Composition (3)
Prerequisite: KNES 360. Formerly PHED 461. Physiological concepts relating body composition factors to exercise and human performance. The scientific basis for the establishment and evaluation of conditioning programs where body composition may play an important role, such as weight control and athletics.

KNES 462 Neural Basis of Human Movement (3)
Prerequisites: [ZOOL 201; and ZOOL 202; and KNES 385] or permission of department. Formerly PHED 462. An introduction to the neural substrates which underlie postural and volitional movement. Neuroanatomical and neurophysiological basis of motor functioning; past and present conceptualizations of motor control and coordination; movement disorders; and maturation of the neuromuscular system.

KNES 470 Seminar For Student Teachers (2)
Formerly PHED 470. A seminar held concurrently with student teaching in physical education. An intensive examination of current problems and issues in teaching physical education.

KNES 480 Measurement in Physical Education (3)
Two hours of lecture and two hours of laboratory per week. *Prerequisite: MATH 110. Formerly PHED 480.* A study of the principles and techniques of educational measurement as applied to teaching of physical education; study of the functions and techniques of measurement in the evaluation of student progress toward the objectives of physical education and in the evaluation of the effectiveness of teaching.

KNES 481 Biophysical Aspects of Human Movement (3)
Prerequisites: KNES 300; and KNES 360; and KNES 370; and KNES 385. Formerly PHED 481. Scientific principles and research techniques in the investigation of the biophysical basis of human movement.

KNES 482 Socio-behavioral Aspects of Human Movement (3)
Prerequisites: KNES 287; and KNES 293; and KNES 350. Formerly PHED 482. Derivation, formulation, and application of research in the socio-behavioral aspects of human movement.

KNES 486 Politics and Economics of Organized Contemporary Sport (3)
Prerequisite: KNES 287. Formerly PHED 486. Interdependence of sport, politics, and economics. The structure, organization, and uses of sport in contemporary societies.

KNES 487 Sports in World Society (3)
Prerequisite: SOCY 100. Formerly PHED 487. Impact and influence of sports are assessed from a sociopolitical frame of reference nationally and internationally.

KNES 489 Field Laboratory Projects and Workshop (1-6)
Repeatable to 6 credits. Formerly PHED 489. Workshops and research projects in special areas of knowledge not covered by regularly structured courses.

KNES 490 Administration of Physical Education and Sport (3)
Prerequisite: KNES 180 or KNES 287. Formerly PHED 490. Principles and functions of administration in physical education and sport. Administrative duties in relation to financing, budgeting, staffing, planning, organizing, directing, coordinating, evaluating, reporting, and discipline.

KNES 491 The Curriculum in Physical Education (3)
Formerly PHED 491. Curriculum sources, principles, and planning concepts, with emphasis on using valid criteria for the selection of content for physical education programs.

KNES 492 History of the Sportswoman in American Organizations (3)
Prerequisite: KNES 293. Formerly PHED 492. Women's involvement in and contributions to America's sporting culture, especially in the 19th and 20th Centuries until enactment of Title IX. The interactions among historical perceptions of women's roles, responsibilities, and potential and their sporting lives; the effects of role stereotyping and opportunities for and directions taken in developing sport organizations. Other issues affecting women's involvement in institutional sport.

KNES 493 History and Philosophy of Sport and Physical Education (3)
Formerly PHED 493. History and philosophical implications of sport and physical education through ancient, medieval, and contemporary periods in western civilization.

KNES 496 Quantitative Methods (3)
Formerly PHED 496. Statistical techniques most frequently used in research pertaining to physical education. Effort is made to provide the student with the necessary skills, and to acquaint him with the interpretations and applications of these techniques.

KNES 497 Independent Studies Seminar (3)
Formerly PHED 497. Discussions of contemporary issues vital to the discipline, critiques of research in the student's area/areas of special interest, completion of a major project where the student will be asked to demonstrate the ability to carry out investigative processes in problem solving and critical writing under faculty direction.

KNES 498 Special Topics in Physical Education (3)
Prerequisite: permission of department. Repeatable when the subject matter is different. Formerly PHED 498. Topics of special interest in areas not covered by regularly scheduled courses.

KNES 603 Advanced Motor Development (3)
Formerly PHED 603. The analysis of major theoretical positions in motor skill development. Stage theory in motor development; development of motor skill memory; the development of motor control and coordination; and the role of reflexes in motor development.

KNES 609 Research Issues in Physical Education (1-3)
Prerequisite: permission of department. Repeatable to 6 credits. Formerly PHED 609. Issues, methodologies, and critical analyses of current research in physical education.

KNES 610 Methods and Techniques of Research (3)
Formerly PHED 610. Studies methods and techniques of research used in physical education an analysis of examples of their use; and practice in their application to problems of interest to the student.

KNES 620 Analysis of Contemporary Athletics (3)
Formerly PHED 620. Studies current problems, practices, and national issues of permanent importance to the conduct of athletic competition in a democracy.

KNES 630 Sociology of Sport in Contemporary Perspective (3)
Formerly PHED 630. Studies social organization and the role of individuals and groups in sport situations: the interrelationship of sport with traditional social institutions; sport as a sub-system and its structure; and sport and social problems.

KNES 640 Supervisory Techniques in Physical Education (3)
Formerly PHED 640. Studies current concepts, principles and techniques of supervision and of their application; observation of available supervising programs, including visits with local supervisors; and practice in the use of selected techniques.

KNES 641 Analysis of Teaching Behavior in Physical Education (3)
Formerly PHED 641. Modes of collecting descriptive data about teaching. Teaching effectiveness variables, models of teaching, teaching/learning styles, and designs for research on teaching. Design of research instruments.

KNES 642 Administrative Direction of Physical Education (3)
Formerly PHED 642. Analyzes administrative problems in the light of sound educational practice. Students concentrate their efforts upon their own on-the-job administrative problems and contribute to the solution of other class members' problems.

KNES 644 Curriculum Construction in Physical Education (3)
Formerly PHED 644. Studies the principles underlying curriculum construction in physical education and the practical applications of these principles to the construction of a curriculum.

KNES 650 Mental and Emotional Aspects of Sports and Recreation (3)
Prerequisite: KNES 350. Formerly PHED 650. An exploration of psychological aspects of physical education, sports and recreation. Includes personality dynamics in relation to exercise and sports. A study is made of the psychological factors in athletic performance and coaching.

KNES 661 Philosophy of Sport (3)
Formerly PHED 661. An examination of the meaning and significance of the phenomena of sport. The influence of the major philosophical points of view as related to modern physical activity and sport in the american society. An exploration of the valid philosophical approaches and processes to the formulation of a philosophy of sport. Exploration and inquiry into the interpretations of facts, meanings, and values in sport.

KNES 662 Readings in American Sport History (3)
Formerly PHED 662. Introduction to the research literature in American Sport History. Analysis of historians' interpretations of how and why American sport developed as it did.

KNES 663 History of Sport in Western Culture (3)
Formerly PHED 663. The history of sport in the ancient, medieval and renaissance West.

KNES 664 Seminar in Colonial and 19th Century Sport (3)
Prerequisite: KNES 662 or permission of department. Formerly PHED 664. Selected topics in the history of the sporting culture in the United States from the seventeenth through the late nineteenth centuries.

KNES 665 Seminar in Modern American Sport, 1890-1970 (3)
Prerequisite: KNES 662 or permission of department. Formerly PHED 665. Selected topics in the history of the sporting culture in the United States from about 1890 to 1970.

KNES 670 Biomechanics Theory (3)
Prerequisite: MATH 141 or MATH 221. Formerly PHED 670. Theoretical basis for understanding the investigation of biomechanical aspects of the human body. Integration of subject matter from physics, engineering, anatomy, kinesiology, and physiology as it relates to the study of human motion and the body as a mechanical system.

KNES 675 Photo-analysis of Human Motion (3)
Prerequisite: KNES 300 or permission of department. Formerly PHED 675. The scientific analysis of human motion with emphasis on photographic principles, cinematographic methodology, and data point resolution as they influence quantification of kinematic variables of human motion.

KNES 681 Physical Performance and the Physically Impaired (3)
Prerequisites: [KNES 333; ZOOL 201; and ZOOL 202] or permission of department. Formerly PHED 681. The physical disabilities most often encountered in educational programs and their impact upon a person's movement abilities. Research regarding the motion of individuals with the presented physical disabilities.

KNES 682 Physical Performance for Those with Learning and Behavioral Disorders (3)
Prerequisite: KNES 333 or permission of department. Formerly PHED 682. Mental retardation, learning disabilities and emotional disturbances, and their impact upon a person's movement abilities. Implications regarding appropriate teaching techniques and programs. Research regarding movement capacities of individuals with the presented disabilities.

KNES 685 Advanced Motor Learning (3)
Prerequisite: KNES 385. Formerly PHED 685. A research-oriented approach to motor learning, including instrumentation and laboratory experimental techniques in motor learning research. Major topics covered are motor learning theories, information processing, motor memory, proprioceptive control of movement, and feedback.

KNES 688 Seminar in Motor Learning and Performance (3)
Prerequisites: KNES 385; and KNES 496. Repeatable to 6 credits. Formerly PHED 688. Discussion of research dealing with advanced topics in motor learning and skilled performance. Recent developments concerning individual differences, refractoriness, anticipation and timing, transfer, retention, and work inhibition are emphasized.

KNES 689 Special Problems in Physical Education (1-6)
Formerly PHED 689. Master or doctoral candidates who desire to pursue special research problems under the direction of their advisor may register for 1-6 hours of credit under this number.

KNES 690 Scientific Bases of Exercise (3)
Prerequisites: KNES 300; and KNES 360. Formerly PHED 690. A critical analysis of the role of physical exercise in modern society with attention given to such topics as: the need for physical exercise, its chronic effects, the role of exercise in attaining good physical condition and fitness, factors determining championship performances, and physical fatigue.

KNES 691 Muscular Aspects of Exercise Physiology (3)
Prerequisite: KNES 360. Formerly PHED 691. Muscular aspects of exercise physiology, including sensory and mechanical factors controlling contraction. Emphasis on the study of muscular fatigue, strength development and hypertrophy, the metabolic and nutritional factors affecting physical performance, and the cellular events associated with exercise and training.

KNES 692 Cardiovascular Aspects of Exercise Physiology (3)
Prerequisite: KNES 360. Formerly PHED 692. A comprehensive consideration of the various cardiovascular factors affecting human physical performance. Emphasis on the regulation of cardiovascular functions during physical activity. Energy liberation and transfer, circulation,

respiration, temperature regulation, physiology of work at altitudes, aerobic endurance training, and exercise, health and aging.

KNES 693 Pulmonary Dynamics in Exercise Physiology (3)
Prerequisite: KNES 690. Formerly PHED 693. Pulmonary factors affecting physical performance. Ventilation, diffusion, blood flow, ventilation-perfusion relationships, gas transport to the periphery, mechanics of breathing, control of ventilation, respiratory physiology in unusual environments and tests of pulmonary function.

KNES 694 Metabolic Aspects of Exercise Physiology (3)
Prerequisite: KNES 360 or KNES 690. Recommended: BCHM 461 and BCHM 462. Formerly PHED 694. Effects of exercise on digestion, absorption, transport, storage, mobilization, and utilization of macronutrients. Emphasis on the effects of exercise training on energy metabolism.

KNES 703 Research Seminar in Motor Development (3)
Prerequisite: KNES 603 or permission of department. Formerly PHED 703. Issues and strategies in the design and evaluation of research in motor skill development. Course culminates in student planning, conducting and interpreting a reserch study.

KNES 764 Advanced Seminar: Research and Writing in American Sport History (3)
Formerly PHED 764. Theoretical and practical study of experiences central to American Sport History. Historical evidence and writing in American sport history.

KNES 770 Advanced Biomechanics (3)
Prerequisites: KNES 670; and CMSC 103. Formerly PHED 770. The application of scientific methods to problems in human biomechanics. Instrumentation for data collection and measurement, mechanical models of the body and their mathematical treatment, and current research topics.

KNES 789 Advanced Seminar (1-3)
Formerly PHED 789. Studies the current problems and trends in selected fields of physical education.

KNES 798 Internship in Physical Education/Sports Management (1-8)
Prerequisite: permission of department. Repeatable to 8 credits. Formerly PHED 798. Practical application of previously acquired skills and knowledge in a sport and/or physical education setting. Emphasis on selected experiences to enhance the total academic program of the student. The internship site assignment will depend upon student's background and career goals.

KNES 799 Master's Thesis Research (1-6)
Formerly PHED 799.

KNES 899 Doctoral Dissertation Research (1-8)
Formerly PHED 899.

LATN – Latin 400 level course prerequisite: LATN 361 or equivalent

LATN 401 Latin Lyric Poetry (3)
Latin lyric poetry. Emphasis on Horace and Catullus.

LATN 402 Tacitus (3)

LATN 403 Roman Satire (3)

LATN 404 Roman Comedy (3)

LATN 405 Lucretius (3)

LATN 410 Latin Historians (3)
Latin historical writing as a literary genre. Influences, style, and literary techniques.

LATN 411 Advanced Latin Grammar (3)
Prerequisite: three years of college Latin or equivalent. An intensive study of the morphology and syntax of the Latin language supplemented by rapid reading.

LATN 415 Virgil's Aeneid (3)
Formerly LATN 305. Virgil's Aeneid: readings of selections in Latin and of the entire epic in English translation along with critical essays.

LATN 420 Cicero and Caesar (3)
Reading and analysis of texts by M. Tullius Cicero and C. Iulius Ceasar, with emphasis on the relationships between them and on the period of the Civil War.

LATN 424 Silver Latin (3)
Reading and analysis of selected texts. Emphasis on the role of Nero and Seneca in literary developments.

LATN 472 Historical Development of the Latin Language (3)
Credit will be granted for only one of the following: LATN 472 or LING 431. An analysis of the development of the Latin language from archaic times to the Middle Ages.

LATN 488 Latin Readings (1-3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs. The reading of one or more selected Latin authors from antiquity through the Renaissance. Reports.

LATN 490 Survey of Latin Literature (3)
Survey of major authors and genres, with extensive readings from a variety of authors and review of grammar.

LATN 499 Independent Study in Latin Language and Literature (3)
Prerequisite: permission of department. Repeatable to 6 credits.

LATN 601 Latin Pedagogy (3)
Theoretical foundations and practical strategies for Latin instruction. Topics include self-paced and intensive approaches, computer-aided instruction, and the teaching of Latin in its cultural context.

LATN 604 Cicero (3)
A study of Cicero's contributions to Roman literature and culture. Readings from the speeches, letters, and/or philosophical and rhetorical works. The development of Cicero's style, his philosophy, and his attitudes toward the changing political scene between 82 and 43 B.C.

LATN 605 Vergil (3)
A study of Vergil's development as a literary artist and Augustan poet through readings in the Eclogues, Georgics, and Aeneid.

LATN 610 Vulgar Latin Readings (3)
Prerequisite: permission of department. An intensive review of the phonology, morphology, and syntax of Classical Latin, followed by the study of the deviations of vulgar Latin from the classical norms, with the reading of illustrative texts. The reading of selections from the peregrinatio ad loca sancta and the study of divergences from classical usage therein, with special emphasis on those which anticipate subsequent developments in the romance languages. Reports.

LATN 620 Archaic Latin (3)
An investigation of both the evolving Latin language and the emerging literary genres of the late third and second centuries B.C.

LATN 622 The Age of Caesar (3)
Life and works of G. Julius Caesar and of his contemporaries in their social, political and intellectual contexts. Close analysis of the texts and familiarization with major developments in modern scholarship.

LATN 623 The Augustan Age (3)
Analysis of the major literary figures and genres in prose and poetry of the period from 43 BC to AD 14.

LATN 624 Silver Age Latin (3)
An investigation of both the evolving Latin language and the major literary figures and genres in prose and poetry of the period from A.D. 14 through the mid-second century.

LATN 630 Latin Literature of the Late Empire (3)
An examination of Latin literary texts from the third to the fifth centuries A.D., Christian as well as pagan.

LATN 631 Medieval Latin (3)
An examination of literary documentary texts in Latin from the end of the Roman Empire to the Renaissance.

LATN 640 Latin Epigraphy (3)
Advanced survey of written materials preserved on stone and other durable objects illustrating Roman culture and the Latin language, providing both the tools necessary for research on Latin epigraphy and an overview of the vast scope of subjects encompassed by the evidence.

LATN 672 Historical Development of the Latin Language (3)
An analysis of the development of the Latin language from the archaic period to the Middle Ages.

LATN 688 Special Topics in Latin Literature (3)
Repeatable to 9 credits if content differs.

LATN 699 Independent Studies in Latin Literature (1-3)
Prerequisite: permission of department. Repeatable to 6 credits.

LATN 799 Master's Thesis Research (1-6)

LBSC – Library Science

LBSC 488 Recent Trends and Issues in Library and Information Services (1-3)
Repeatable to 9 credits. Discussions of recent trends and issues in library and information services. Designed for practicing professionals.

LBSC 499 Workshops, Clinics, and Institutes (1-9)
Repeatable to 9 credits. Workshops, clinics, and institutes developed around specific topics or problems. Primarily for practicing librarians.

LBSC 600 Proseminar: Development and Operation of Libraries and Information Services (3)
Prerequisite: permission of department. Background and orientation for advanced study in library and information services, including communication, the use and economics of information, libraries as social institutions and as organizations, and professionalism. Required of all MLS students.

LBSC 602 Curatorship and Records Management (3)
Prerequisite: permission of department. Background and orientation for advanced study in library and information services, including agencies and institutions such as historical museums, genealogical societies, rare book collections, and archives. Theory and practices of curatorship of historical and records collections and relevant materials, such as magnetic tapes, photographs and media. Alternate to LBSC 600 for HILS students.

LBSC 603 Library Systems Analysis (3)
Prerequisite: permission of department. Systems approach to library and information services, emphasizing managerial decision making and problem solving. Model building, flowcharting, motion and time study, cost analyses, system design, and evaluation methods.

LBSC 611 Archives and Libraries in Western Civilization (3)
Prerequisite: permission of department. Survey of the development of archives, libraries, and their materials and personnel from the earliest record to the present. Emphasis on the socio-

economic forces controlling the development of these institutions, and on their role in the formation and continuation of Western civilization.

LBSC 612 History of Books and Printing (3)
Prerequisite: permission of department. History of the book in its various forms from the earliest surviving records to contemporary production, including the origin and evolution of the alphabet and scripts, writing materials, manuscripts and decorative arts leading to the book as known today. The invention of printing, leading printers and type designs, and book distribution during both the handpress and machinepress periods.

LBSC 621 Library Service to the Disadvantaged (3)
Prerequisite: permission of department. Problems of service to the disadvantaged (ethnic/racial minorities, handicapped, institutionalized, and aged). Case studies on the creation of library programs and the resolution of problems of service. Includes field experience.

LBSC 630 Library Administration (3)
Prerequisite: permission of department. Administrative theory and principles and their implications for and applications to managerial activity in libraries and other information organizations.

LBSC 641 Selection and Evaluation of Instructional Media (3)
Prerequisite: permission of department. Development of criteria and procedures for selecting and evaluating media for instruction. Systematic planning for media use. Exploration of present and evolving issues.

LBSC 643 Library Media Specialists in Educational Systems (3)
Prerequisite: permission of department. Educational contexts in which library media specialists function. Activities and roles of library media specialists within educational systems. Cognitive, affective, and social characteristics of client groups.

LBSC 645 Children's Literature and Materials (3)
Prerequisite: permission of department. Survey of literature and other materials for children and youth and the criteria for evaluating such materials as they relate to the needs, interests, and capabilities of young readers.

LBSC 651 Reference and Information Services (3)
Prerequisite: permission of department. Information and reference systems, services, and tools provided in libraries and information centers. Problems and concepts of communication, question negotiation, and search processes. Bibliographic control and major types of information sources and modes of information delivery. Required of all MLS students.

LBSC 671 Organization of Recorded Knowledge (3)
Prerequisite: permission of department. Principles of organizing information for intellectual and physical access; subject indexing and classification and descriptive cataloging. Major systems and standards used in the United States. Organizational issues of bibliographic control. Required of all MLS students.

LBSC 675 Information Storage and Retrieval (ISAR) Systems (3)
Prerequisite: permission of department. Principles of organizing information underlying both manual and mechanized ISAR systems, including the conceptual structure of index languages and search strategies, file organization, typology of classifications, abstracting, and indexing.

LBSC 690 Data Processing for Libraries and Information Services (3)
Prerequisite: permission of department. Credit will be granted for only one of the following: LBSC 690 or LBSC 691. Introduction to computers and their uses in libraries and other information systems, including systems analysis, database management systems, file structure, structured programming, and data processing applications and their management.

LBSC 691 Microcomputers in Information Processing (3)
Prerequisite: permission of department. Credit will be granted for only one of the following: LBSC 690 or LBSC 691. Introduction to microcomputers and their roles in processing information and

knowledge in schools, libraries, and other information agencies. Programming, database management, information organization and retrieval, word processing, systems analysis, library automation, and instructional applications.

LBSC 701 Research Methods in Library and Information Studies (3)
Prerequisite: permission of department. Techniques and strategies of research as applied to the definition, investigation, and evaluation of information problems.

LBSC 702 User Instruction (3)
Prerequisite: permission of department. Critical analysis of the rationale, content, and processes of user instruction in library and information settings.

LBSC 704 Seminar in Information Science (3)
Prerequisite: permission of department. Fundamentals of information science. Nature of and modulation in observation and messages in human and machine communication from the viewpoint of the physical, psychological, and logical transformations they undergo in their paths from message source to recipient. Cybernetic variety, basic constraints or variety in information systems and classes as used in searching. Models for communicating information.

LBSC 706 Seminar in International and Comparative Librarianship and Information Science (3)
Prerequisite: permission of department. Comparison and contrast of bibliographic systems, institutions, service arrangements, and professional patterns in developed and developing cultures. Libraries, information organizations, and international information systems viewed against the backdrop of national cultures. Influences of social, political, and economic factors upon these forms.

LBSC 707 Field Study in Library Service (3)
Prerequisites: LBSC 600; and LBSC 651; and LBSC 671; and [LBSC 690 or LBSC 691] and permission of both department and instructor. Unpaid, supervised experience within library operations and/or the opportunity to perform a study to solve a specific problem in a suitable library or other information agency.

LBSC 708 Special Topics in Library and Information Service (1-3)
Prerequisite: permission of department. Repeatable with different topics, but no student may earn more than 9 credits in LBSC 708 nor more than a total of 12 credits in both LBSC 708 and LBSC 709. Consult Schedule of Classes or CLIS informational materials for specific offerings.

LBSC 709 Independent Study (1-3)
Prerequisite: permission of department. No student may earn more than 9 hours under LBSC 709 nor more than a total of 12 hours in both LBSC 708 and LBSC 709. Intensive individual study, reading, or research in an area of specialized interest under faculty supervision. Registration limited to the advanced student with the approval of the advisor and of the faculty member involved.

LBSC 722 Communication and Libraries (3)
Prerequisite: permission of department. Theory and research in the multidisciplinary domain of communication. User needs and preferences, technology transfer, and knowledge diffusion. Transmission and intelligibility across language, cultural, and other barriers. Applications to library practice.

LBSC 723 Libraries and Information Services in the Social Process (3)
Prerequisite: permission of department. Community, institutional, and cultural influences on information services. Impact of libraries and information services on the social environment.

LBSC 724 Public Library Seminar (3)
Prerequisite: permission of department. Organization, support, and service patterns of public libraries. The public library in national, state, and local contexts.

LBSC 727 Science Information and the Organization of Science (3)
Prerequisite: permission of department. Institutional environments in which science information is produced, evaluated, and disseminated. Evolution of organizational relationships and development of new forms, such as think-tanks and contract research firms. Influence of science policy on science communication.

LBSC 733 Seminar in Library and Information Networks (3)
Prerequisite: permission of department. Cooperation and networks of libraries and information services. Critical issues in network planning, organization, economics, technology, and services.

LBSC 734 Seminar in the Academic Library (3)
Prerequisite: permission of department. Role of the academic library within the framework of higher education. Planning programs and services, collections, support, fiscal management, physical plant, and cooperation.

LBSC 736 Designing Information Products and Services (3)
Prerequisite: permission of both department and instructor. The process of inventing and designing information products and services studied through student projects. Identification of needs for information. Sources of support for new products and services; economic, personnel, and marketing considerations; and strategies for updating and maintaining information products and services.

LBSC 737 Seminar in the Special Library and Information Center (3)
Prerequisites: permission of department; and LBSC 630 or permission of instructor. Role of special libraries and information centers in the information transfer process. Analysis of the information transfer system; information needs and uses; management of special libraries and information centers; and types, such as governmental or industrial libraries, archives, and information analysis centers.

LBSC 741 Seminar in School Library Media Programs (3)
Prerequisites: permission of department; and LBSC 643 or permission of instructor. Development, management, and evaluation of school library media programs at all levels.

LBSC 742 Instructional Development Roles of Library Media Specialists (3)
Prerequisites: permission of department; and LBSC 643 or permission of instructor. Independent and consulting responsibilities of the library media specialist in instructional systems design. Systematic design, development, and evaluation of instructional strategies and products in schools and other settings.

LBSC 744 Field Study in School Library Media Programs (3)
Prerequisites: permission of department; and LBSC 741; and [LBSC 742 or EDCI 605 or permission of instructor]. Practicum and seminar in library media programs at the elementary, middle, and secondary levels.

LBSC 745 Storytelling Materials and Techniques (3)
Prerequisite: permission of department. Literary sources and instruction and practice in oral techniques.

LBSC 746 Analysis of Client Groups: Young Adults (3)
Prerequisite: permission of department. Special characteristics of youth and resultant implications for the interpretation of information, materials, and services in all types of libraries and information settings.

LBSC 748 Advanced Seminar in Children's Literature (3)
Prerequisites: permission of department; and LBSC 645 or permission of instructor. Selected topics in literature for children and adolescents, including historical aspects, individual authors, and major themes and trends.

LBSC 750 Advanced Reference Services (3)
Prerequisites: permission of department; and either LBSC 651 or permission of instructor. Analysis of information problems, search strategy development, and theoretical and administrative considerations of reference services. Evaluation and searching of online databases and other computerized resources.

LBSC 751 Literature and Research in the Humanities (3)
Prerequisites: permission of department; and either LBSC 651 or permission of instructor. Analysis of information structure, research methods, bibliographic organization, and reference services in the humanities, including religion, philosophy, performing arts, visual arts, and language and literature.

LBSC 752 Literature and Research in the Arts (3)
Prerequisites: permission of department; and either LBSC 651 or permission of instructor. Interdisciplinary treatment of bibliography and research trends in the visual and performing arts, emphasizing architecture, painting, sculpture, and the minor arts. Examination of core bibliographies, special organizational problems, terminologies, and classification systems.

LBSC 753 Literature and Research in the Social Sciences (3)
Prerequisites: permission of department; and either LBSC 651 or permission of instructor. Factors affecting the generation and use of social science information, including characteristics of the social sciences and their methodology, the structure of social science literature, and control of diverse forms of social science information.

LBSC 756 Literature and Research in Science and Technology (3)
Prerequisite: permission of department; and either LBSC 651 or permission of instructor. Scientific and technical information, its generation and use by scientists and engineers, and its flow through formal and informal channels. Principal sources of scientific and technical information, and their characteristics, scope, and utilization, with emphasis on materials selection for scientific and technical collections and the adoption of service strategies to fit different clienteles.

LBSC 762 Health Information Sources and Their Use (3)
Prerequisite: permission of department; and either LBSC 651 or permission of instructor. Health sciences reference sources, stressing specialized reference and services characteristic of clinical medicine and health care delivery. Major emphasis on literature searches using MEDLINE and other manual and online databases. Considerable time spent at the National Library of Medicine or another medical library.

LBSC 764 Legal Literature (3)
Prerequisite: permission of department; and either LBSC 651 or permission of instructor. Survey and evaluation of information sources in law, with emphasis on the structure of federal and state governments and the bibliographic organization of legal research materials.

LBSC 766 Business Information Services (3)
Prerequisite: permission of department; and either LBSC 651 or permission of instructor. Survey and analysis of information sources in business, finance, and economics with emphasis on their use in problem solving.

LBSC 767 Governmental Information Systems (3)
Prerequisite: permission of department; and either LBSC 651 or permission of instructor. Production and distribution of government information and its control and utilization within information agencies. State, local, foreign, and international governmental information practices.

LBSC 770 Bibliographic Control (3)
Prerequisite: permission of department; and either LBSC 671 or permission of instructor. Problems and current issues in bibliographic control. Study and use of subject heading lists, thesauri, classification schemes, cataloging standards, and bibliographic utilities.

LBSC 772 Seminar in the Organization of Knowledge (3)
Prerequisite: permission of department; and either LBSC 671 or permission of instructor. Topics and issues in the organization of knowledge.

LBSC 774 Seminar in Linguistic Topics (3)
Prerequisite: permission of department; and either LBSC 671 or permission of instructor. Recommended: LBSC 675. Topics in linguistics with applications in information science. Syntax and semantics as they apply to the analysis of communication processes and to natural language processing for information storage and retrieval.

LBSC 775 Construction and Maintenance of Index Languages and Thesauri (3)
Prerequisite: permission of department; and LBSC 675 or permission of instructor. Design of index languages/thesauri and procedures for their construction. Analysis and evaluation of existing index languages/thesauri. Term project in constructing an index language/thesaurus.

LBSC 781 Problems of Nonbook Materials (3)
Prerequisite: permission of department. Examination of nonbook materials, such as audiorecords, motion pictures, maps, videorecords, machine-readable data files, and realia. Technical services applicable to nonbook materials.

LBSC 782 Manuscript Collections (3)
Prerequisite: permission of department. Management of archival and manuscript collections with analysis of special problems in development, control, access, and use of documents, emphasizing both personal papers and official records.

LBSC 783 Seminar in Technical Services (3)
Prerequisite: permission of department. Technical services in large libraries, including acquisitions, cataloging, serials control, automation, cooperative programs, and managerial controls.

LBSC 784 Resources of American Libraries (3)
Prerequisite: permission of department. Distribution and extent of library resources, means of surveying collections, mechanisms for inter-institutional cooperation in building collections, and means of developing research collections in special subject fields.

LBSC 785 Reprography Management (3)
Prerequisite: permission of department. Technologies for and management of the reproduction, storage, and transmission of graphic images.

LBSC 786 Library and Archives Preservation (3)
Prerequisite: permission of department. Literature and key issues in the preservation of archival and library materials. The development of preservation programs and the establishment and maintenance of effective management techniques. The nature of the materials from which archives and books are made, causes of damage and deterioration, binding structures and environmental concerns, will be discussed within the context of general archives and libraries administration.

LBSC 787 Planning of Library Facilities (3)
Prerequisite: permission of department. Planning of space, design and choice of equipment, and other physical planning aspects of libraries. The use of existing facilities, their expansion or remodelling, and the planning of new buildings. Field trips to characteristic library buildings and facilities.

LBSC 790 Advanced Data Processing in Libraries (3)
Prerequisite: permission of department; and LBSC 690 or permission of instructor. Analysis of retrieval systems and intensive study of machine applications in the acquisition, analysis, coding, retrieval, and display of information.

LBSC 791 Computer Applications in Information Management (3)
Prerequisite: permission of department; and either LBSC 690 or LBSC 691 or permission of instructor. Microcomputer-based software packages as augmentations of human information

processing. Applications to decision making in libraries, information centers, and schools. Application packages for database management, word processing, statistical analysis, decision support, instruction and learning, telecommunications, and library automation. Small group work interpreting and analyzing problems using electronic tools.

LBSC 794 Principles of Software Evaluation (3)
Prerequisite: permission of department; and either LBSC 690 or LBSC 691. Human factors and other criteria for evaluating software for instructional, library, and information applications. Systematic procedures for evaluating and selecting appropriate packages.

LBSC 799 Master's Thesis Research (1-6)

LBSC 802 Seminar in Research Methods and Data Analysis (3)
Prerequisite: permission of department; and coursework in statistics and introduction to research methods; and permission of instructor. Topics and issues in information studies research. Design and conduct of research project.

LBSC 878 Doctoral Seminar in Information Studies (3)
Prerequisite: permission of department. Limited to doctoral students and advanced MLS students with permission of instructor. Repeatable with different topics. Seminar topics offered as faculty and student interests warrant. Topic varies.

LBSC 899 Doctoral Dissertation Research (1-8)

LING – Linguistics

LING 410 Grammar and Meaning (3)
Prerequisite: LING 312. The basic notions of semantic theory: reference, quantification, scope relations, compositionality, thematic relations, tense and time, etc. The role these notions play in grammars of natural languages. Properties of logical form and relationship with syntax.

LING 411 Comparative Syntax (3)
Prerequisite: LING 312. Comparison of data from a variety of languages with respect to some aspect of current versions of syntactic theory in order to investigate how parameters of universal grammar are fixed differently in different languages. Attempts to work out fragments of grammars for some languages.

LING 419 Topics in Syntax (3)
Repeatable to 6 credits if content differs.

LING 420 Word Formation (3)
Prerequisite: LING 322. Definition of shape and meaning of possible words, both across languages and within particular languages. Interaction between principles of word formation and other components of a grammar: syntax, logical form and phonology.

LING 421 Advanced Phonology (3)
Prerequisite: LING 322. Topics in current phonological theory, as they relate to data from the sound systems of various languages. Segmental and prosodic analysis. Discussion of autosegmental theory, metrical theory, etc.

LING 429 Topics in Phonology (3)
Repeatable to 6 credits if content differs.

LING 430 Language Change (3)
Prerequisite: LING 240. Changes in grammars from generation to generation. Consequences for the theory of grammars. Traditional work on historical change.

LING 431 Indo-European Studies (3)
Prerequisite: LING 330. Credit will be granted for only one of the following: LATN 472 or LING 431. Reconstruction of Proto-Indo-European according to the theories of the Neo-grammarians and their followers. The development of Proto-Indo-European into its descendant languages.

LING 439 Topics in Diachronic Linguistics (3)
Repeatable to 6 credits if content differs.

LING 440 Grammars and Cognition (3)
Relationship between the structure, development and functioning of grammars and the structure, development and functioning of other mental systems. Interpretations of experimental and observational work on children's language, aphasia, speech production and comprehension.

LING 445 Computer Models of Language (3)
Prerequisite: LING 240. The use of linguistic theory to improve psychological models of language comprehension. Formal and computer modelling of language processing systems.

LING 451 Grammars and Variation (3)
Prerequisite: LING 311. Grammars and the use of language in a variety of styles: formal, casual, literary, etc. Consequences for concepts of grammars. Variation theory. Literary styles.

LING 453 Mathematical Approaches to Language (3)
Prerequisite: LING 312. The aspects of mathematics used in linguistic discussions: recursion theory, Chomsky's hierarchy of grammars, set theory, Boolean algebra, finite state grammars, context-free grammars, etc. Applications to theories of grammars. Formalizations of grammatical theories.

LING 455 Second Language Teaching (3)
Relationship between theories of grammars, and techniques used for teaching and learning second languages, and for the teaching and learning of English in schools.

LING 457 Grammars and Discourse (3)
Prerequisite: LING 240. The use of a person's grammar in communication, sentence production. Speech act theory, pragmatics.

LING 487 Computer Science for Cognitive Studies (3)
Also offered as PHIL 487. Credit will be granted for only one of the following: LING 487 or PHIL 487. List processing and discrete mathematics. Preparation for the study of artificial intelligence and other mathematicaly oriented branches of cognitive studies. Intended for students of linguistics, philosophy, and psychology. LISP computer language, graphs and trees, the concept of computational complexity, search algorithms.

LING 499 Directed Studies in Linguistics (1-3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs. Independent study or research on language under the supervision of a faculty member.

LING 610 Syntactic Theory (3)
Prerequisite: LING 312. Relationship between syntax and elements of logical form: reference, quantification, scope relations, compositionality, tense and time, etc.

LING 611 Issues in Syntax (3)
Prerequisite: LING 610. Topics of current theoretical interest examined through data from a variety of languages.

LING 620 Phonological Theory (3)
Prerequisite: LING 322. Topics in current phonological theory, as they relate to data from various languages. Segmental and prosodic analysis. Autosegmental theory, metrical theory, etc.

LING 621 Issues in Phonology (3)
Prerequisite: LING 620. Topics of current interest in phonological theory examined through data from several languages.

LING 625 Morphology and the Lexicon (3)
The structure of words and investigation of how word formation processes interact with other components of grammar.

LING 630 Diachronic Linguistics (3)
The ways in which grammars may change from generation to generation and the relevance of such changes for theories of the human linguistic capacity. Consideration of traditional work on historical change.

LING 640 Competence and Performance (3)
Prerequisite: LING 312 or permission of instructor. The relationship of grammatical theory to performance models of language acquisition, processing, and breakdown.

LING 644 Language Acquisition (3)
Prerequisite: LING 640. Interpretations of observational and experimental work on children's language development, and relationship between developmental stages and theories of human language faculties.

LING 645 Speech Processing (3)
Prerequisite: LING 312 or permission of instructor. The way in which grammars are used in sentence processing; attempts to construct language parsers, including computer models.

LING 650 History of Linguistics (3)
Prerequisite: LING 312. Different ways in which people have thought about language. Cartesian and neogrammarian theories. Development of the generative research program.

LING 658 History of a Language (3)
Repeatable to 6 credits if content differs. Detailed examination of the history of a single language or language family.

LING 659 Structure of a Language (3)
Repeatable to 6 credits if content differs. Detailed examination of a particular language, which may vary from year to year.

LING 689 Independent Studies (3)
Prerequisite: permission of instructor. For LING majors only. Repeatable to 6 credits if content differs. Independent studies in grammatical theory.

LING 698 Directed Study (1-3)
Repeatable to 6 credits if content differs.

LING 799 Master's Thesis Research (1-6)

LING 819 Seminar in Syntactic Theory (3)
Prerequisite: LING 611. Repeatable to 6 credits if content differs. Current topics in syntactic research.

LING 829 Seminar in Phonological Theory (3)
Prerequisite: LING 621. Repeatable to 6 credits if content differs. Current topics in research on phonology and morphology.

LING 839 Seminar in Language Change (3)
Prerequisite: LING 630. Repeatable to 6 credits if content differs. Topics in work on historical change in language.

LING 849 Seminar in Psycholinguistics (3)
Prerequisite: LING 640. Repeatable to 6 credits if content differs. Topics in the psychology of language: child language, aphasia, language processing.

LING 889 Directed Research (1-8)

LING 895 Doctoral Research Paper (1-6)

LING 899 Doctoral Dissertation Research (1-8)

MAPL – Applied Mathematics

MAPL 460 Computational Methods (3)
Prerequisites: MATH 240; and MATH 241; and [CMSC 110 or CMSC 113] or equivalent. Also offered as CMSC 460. Credit will be granted for only one of the following: MAPL/CMSC 460

and MAPL/CMSC 466. Basic computational methods for interpolation, least squares, approximation, numerical quadrature, numerical solution of polynomial and transcendental equations, systems of linear equations and initial value problems for ordinary differential equations. Emphasis is on methods and their computational properties rather than their analytic aspects. Intended primarily for students in the physical and engineering sciences.

MAPL 466 Introduction to Numerical Analysis I (3)
Prerequisites: [MATH 240; and MATH 241; and CMSC 110] or equivalent. Also offered as CMSC 466. Credit will be granted for only one of the following: MAPL/CMSC 460 and MAPL/CMSC 466. Floating point computations, direct methods for linear systems, interpolation, solution of nonlinear equations.

MAPL 467 Introduction to Numerical Analysis II (3)
Prerequisite: MAPL/CMSC 466 or permission of department. Also offered as CMSC 467. Advanced interpolation, linear least squares, eigenvalue problems, ordinary differential equations, Fast Fourier Transforms.

MAPL 472 Methods and Models in Applied Mathematics I (3)
Prerequisites: [MATH 241; and MATH 246; and MATH 240; and PHYS 161 or 171] or permission of department. Recommended: one of the following: MATH 410, MATH 414, MATH 415, MATH 462, MATH 463, PHYS 262, PHYS 273. Also offered as MATH 472. Credit will be granted for only one of the following: MATH 472 and MAPL 472. Mathematical models in fluid dynamics and elasticity, both linear and non-linear partial differential equations, variational characterizations in eigenvalue problems, numerical algorithms. Additional optional topics as time permits. Some examples are Hamiltonian systems, Maxwell's equations, non-linear programming.

MAPL 477 Optimization (3)
Prerequisite: CMSC/MAPL 460, 466, or 467. Also offered as CMSC 477. Credit will be granted for only one of the following: CMSC 477 or MAPL 477. Linear programming including the simplex algorithm and dual linear programs, convex sets and elements of convex programming, combinatorial optimization, integer programming.

MAPL 498 Selected Topics in Applied Mathematics (1-3)
Repeatable to 6 credits if content differs. Topics in applied mathematics of special interest to advanced undergraduate students.

MAPL 600 Advanced Linear Numerical Analysis (3)
Prerequisite: CMSC/MAPL 666 or permission of instructor. Also offered as CMSC 760. Advanced topics in numerical linear algebra, such as dense eigenvalue problems, sparse elimination, iterative methods, and other topics.

MAPL 604 Numerical Solution of Nonlinear Equations (3)
Prerequisites: CMSC/MAPL 666 and CMSC/MAPL 667; or permission of instructor. Also offered as CMSC 762. Numerical solution of nonlinear equations in one and several variables. Existence questions. Minimization methods. Selected applications.

MAPL 607 Advanced Numerical Optimization (3)
Prerequisites: MATH 410; and MAPL/CMSC 477; or equivalent. Modern numerical methods for solving unconstrained and constrained nonlinear optimization problems in finite dimensions. Design of computational algorithms and the analysis of their properties.

MAPL 610 Numerical Solution of Ordinary Differential Equations (3)
Prerequisites: a two semester course in numerical analysis and a one semester advanced undergraduate course in ordinary differential equations; or permission of instructor. Numerical methods for solving initial value problems in ordinary differential equations. Single step and multi-step methods, stability and convergence theory, adaptive methods, methods for stiff systems. Shooting methods for boundary value problems.

MAPL 612 Numerical Methods in Partial Differential Equations (3)
Prerequisite: a graduate level one semester course in partial differential equations or a theoretical graduate level course in applied field such as fluid mechanics; or permission of instructor. Finite difference methods for elliptic, parabolic, and hyperbolic partial differential equations. Additional topics such as spectral methods, variational methods for elliptic problems, stability theory for hyperbolic initial-boundary value problems, and solution methods for conservation laws.

MAPL 614 Mathematics of the Finite Element Method (3)
Prerequisite: one semester graduate level course in partial differential equations; or permission of instructor. Variational formulations of linear and nonlinear elliptic boundary value problems; formulation of the finite element method; construction of finite element subspaces; error estimates; eigenvalue problems; time dependent problems.

MAPL 640 System Theory (3)
Also offered as ENEE 663. General system models. State variables and state spaces. Differential dynamical systems. Discrete time systems. Linearity and its implications. Controllability and observability. State space structure and representation. Realization theory and algorithmic solutions. Parameterizations of linear systems; canonical forms. Basic results from stability theory. Stabilizability. Fine structure of linear multivariable systems; minimal indices and polynomial matrices. Inverse Nyquist array. Geometric methods in design. Interplay between frequency domain and state space design methods. Interactive computer-aided design methods.

MAPL 641 Optimal Control (3)
Prerequisite: ENEE 460. Also offered as ENEE 664. General optimization and control problems. Static optimization problems. Linear and nonlinear programming methods. Geometric interpretations. Dynamic optimization problems. Discrete time maximum principle and applications. Pontryagin maximum principle in continuous time. Dynamic-programming. Feedback realization of solutions. Extensive applications to problems in optimal design, navigation and guidance, power systems. Introduction to state constrained and singular optimal control problems.

MAPL 644 Estimation and Detection Theory (3)
Prerequisite: ENEE 620 or equivalent. Also offered as ENEE 621. Estimation of unknown parameters, Cramer-Rao lower bound: optimum (map) demodulation: filtering, amplitude and angle modulation, comparison with conventional systems; statistical decision theory; Bayes, minimax, Neyman/Pearson, criteria-68 simple and composite hypotheses; application to coherent and incoherent signal detection; m-ary hypotheses; application to uncoded and coded digital communication systems.

MAPL 655 Asymptotic Analysis and Special Functions I (3)
Prerequisite: MATH 413 or MATH 463. Also offered as MATH 655. Transcendental equations, gamma function, orthogonal polynomials, Bessel functions, integral transforms, Watson's lemma, Laplace's method, stationary phase, analytic theory of ordinary differential equations, Liouville-Green (or WKBJ) approximation.

MAPL 656 Asymptotic Analysis and Special Functions II (3)
Prerequisite: MATH/MAPL 655. Also offered as MATH 656. Steepest descents, coalescing saddle-points, singular integral equations, irregular singularities, Bessel, hypergeometric, and Legendre functions, Euler-Maclaurin formula, Darboux's method, turning points, phase shift.

MAPL 666 Numerical Analysis I (3)
Prerequisites: MAPL 466; and MATH 410. Also offered as CMSC 666. Iterative methods for linear systems, piecewise interpolation, eigenvalue problems, numerical integration.

MAPL 667 Numerical Analysis II (3)
Prerequisite: MAPL 666. Also offered as CMSC 667. Nonlinear systems of equations, ordinary differential equations, boundary value problems.

MAPL 670 Ordinary Differential Equations I (3)
Prerequisite: MATH 405; and MATH 410 or equivalent. Also offered as MATH 670. Existence and uniqueness, linear systems usually with Floquet theory for periodic systems, linearization and stability, planar systems usually with Poincare-Bendixson theorem.

MAPL 671 Ordinary Differential Equations II (3)
Prerequisite: MATH 630; and MATH/MAPL 670 or equivalent. Also offered as MATH 671. The content of this course varies with the interests of the instructor and the class. Stability theory, control, time delay systems, Hamiltonian systems, bifurcation theory, and boundary value problems.

MAPL 673 Classical Methods in Partial Differential Equations I (3)
Prerequisite: MATH 410 or equivalent. Also offered as MATH 673. Cauchy problem for the wave equation and heat equation, Dirichlet and Neumann problem for Laplace's equation. Classification of equations, Cauchy-Kowaleski theorem. General second order linear and nonlinear elliptic and parabolic equations.

MAPL 674 Classical Methods in Partial Differential Equations II (3)
Prerequisite: MATH/MAPL 673. Also offered as MATH 674. General theory of first order partial differential equations, characteristics, complete integrals, Hamilton-Jacobi theory. Hyperbolic systems in two independent variables, existence and uniqueness, shock waves, applications to compressible flow.

MAPL 680 Eigenvalue and Boundary Value Problems I (3)
Prerequisite: MATH 405 and MATH 410 or equivalent. Also offered as MATH 680. Operational methods applied to ordinary differential equations. Introduction to linear spaces, compact operators in Hilbert space, study of eigenvalues.

MAPL 681 Eigenvalue and Boundary Value Problems II (3)
Prerequisite: MATH/MAPL 680. Also offered as MATH 681. Boundary value problems for linear differential equations. Method of energy integrals applied to Laplace's equation, heat equation and the wave equation. Study of eigenvalues.

MAPL 685 Modern Methods in Partial Differential Equations I (3)
Prerequisite: MATH 630 and MATH 631. Also offered as MATH 685. Spaces of distributions, Fourier transforms, concept of weak and strong solutions. Existence, uniqueness and regularity theory for elliptic and parabolic problems using methods of functional analysis.

MAPL 686 Modern Methods in Partial Differential Equations II (3)
Prerequisite: MATH/MAPL 685. Also offered as MATH 686. Emphasis on nonlinear problems. Sobolev embedding theorems, methods of monotonicity, compactness, applications to elliptic, parabolic and hyperbolic problems.

MAPL 698 Advanced Topics in Applied Mathematics (1-4)
Repeatable if content differs.

MAPL 699 Applied Mathematics Seminar (1-3)
Repeatable if content differs. Seminar to acquaint students with a variety of applications of mathematics and to develop skills in presentation techniques.

MAPL 701 Introduction to Continuum Mechanics (3)
Background from algebra and geometry, kinematics of deformation. Stress equations of motion, thermodynamics of deforming continua. Theory of constitutive relations. Materials with memory. Initial boundary value problems of nonlinear solid and fluid thermomechanics. Boundary value problems of linear theories of solids and fluids.

MAPL 710 Linear Elasticity (3)
Prerequisite: MAPL 701. Formulation of the equations. Compatability, uniqueness, existence, representation and qualitative behavior of solutions. Variational principles. St. Venant beam problems, plane strain and plane stress, half-space problems, contact problems, vibration problems, wave propagation. Emphasis is placed on formulation and technique rather than on specific examples.

MAPL 711 Non-linear Elasticity (3)
Prerequisite: MAPL 701. Formulation of initial boundary value problems. Constitutive restrictions. Special solutions. Perturbation methods and their validity. Theories of rods and shells. Buckling and stability. Shock propagation.

MAPL 720 Fluid Dynamics I (3)
A mathematical formulation and treatment of problems arising in the theory of incompressible, compressible and viscous fluids.

MAPL 721 Fluid Dynamics II (3)
A continuation of MAPL 720.

MAPL 731 Information Theory (3)
Corequisite: ENEE 620. Prerequisite: STAT 400 or equivalent. Also offered as ENEE 721. Information measure, entropy, mutual information: source encoding; noiseless coding theorem, noisy coding theorem; exponential error bounds; introduction to probabilistic error correcting codes, block and convolutional codes and error bounds; channels with memory; continuous channels; rate distortion function.

MAPL 732 Error Correcting Codes (3)
Also offered as ENEE 722. Introduction to linear codes; bounds on the error correction capabilities of codes; convolutional codes with threshold, sequential and Viterbi decoding; cyclic random error correcting codes; P-N sequences; cyclic and convolutional burst error correcting codes.

MAPL 735 Advanced Methods and Algorithms in Detection and Filtering (3)
Prerequisite: ENEE 621. Also offered as ENEE 772. Foundations of random processes. Conditional expectations. Markov processes and martingales. Ito calculus. Detection and estimation of continuous signals with continuous observations. Jump processes. Detection and estimation with discontinuous observations. Discrete-time case. Fast algorithms for digital filtering problems.

MAPL 740 Mathematical Methods in Control Engineering (3)
Prerequisite: ENEE 663. Also offered as ENEE 760. Applications of compactness in control and communication, geometric methods in optimal control of lumped and distributed systems and harmonic analysis of linear systems. Applications to control and estimation problems.

MAPL 741 Control of Distributed Parameter Systems (3)
Prerequisite: an introductory course in functional analytic methods at the level of ENEE 760, and background in control and system theory. Also offered as ENEE 761. Study of systems governed by partial differential equations. Delay systems. Boundary and distributed control, Lyapunov stability. Optimal control of systems governed by partial differential equations and of delay systems. Applications to continuum mechanics, distributed networks, biology, economics, and engineering.

MAPL 742 Stochastic Control (3)
Prerequisite: ENEE 620 or equivalent; and ENEE 663/MAPL 640. Also offered as ENEE 762. Stochastic control systems, numerical methods for the Ricatti equation, the separation principle,

control of linear systems with Gaussian signals and quadratic cost, nonlinear stochastic control, stochastic stability, introduction to stochastic games.

MAPL 799 Master's Thesis Research (1-6)

MAPL 899 Doctoral Dissertation Research (1-8)

MATH – Mathematics

MATH 400 Vectors and Matrices (3)
Prerequisite: MATH 221 or equivalent. Not open to students in the CMPS College. Credit will be granted for only one of the following: MATH 240, MATH 400, or MATH 461. The essentials of matrix theory needed in the management, social and biological sciences. Main topics: systems of linear equations, linear independence, rank, orthogonal transformations,eigenvalues, the principal axes theorem. Typical applications: linear models in economics and in statistics, Markov chains, age-specific population growth.

MATH 401 Applications of Linear Algebra (3)
Prerequisite: MATH 240 or MATH 400 or MATH 461. Various applications of linear algebra: theory of finite games, linear programming, matrix methods as applied to finite Markov chains, random walk, incidence matrices, graphs and directed graphs, networks, transportation problems.

MATH 402 Algebraic Structures (3)
Prerequisite: MATH 240 or equivalent. Not open to mathematics graduate students. Credit will be granted for only one of the following: MATH 402 or MATH 403. For students having only limited experience with rigorous mathematical proofs. Parallels MATH 403. Students planning graduate work in mathematics should take MATH 403. Groups, rings, integral domains and fields, detailed study of several groups; properties of integers and polynomials. Emphasis is on the origin of the mathematical ideas studied and the logical structure of the subject.

MATH 403 Introduction to Abstract Algebra (3)
Prerequisites: MATH 240 and MATH 241, or equivalent. Credit will be granted for only one of the following: MATH 402 or MATH 403. Integers; groups, rings, integral domains, fields.

MATH 404 Field Theory (3)
Prerequisite: MATH 403. Algebraic and transcendental elements, Galois theory, constructions with straight-edge and compass, solutions of equations of low degrees, insolubility of the Quintic, Sylow theorems, fundamental theorem of finite Abelian groups.

MATH 405 Linear Algebra (3)
Prerequisite: MATH 240 or MATH 461. An abstract treatment of finite dimensional vector spaces. Linear transformations and their invariants.

MATH 406 Introduction to Number Theory (3)
Prerequisite: MATH 141 or permission of department. Integers, divisibility, prime numbers, unique factorization, congruences, quadratic reciprocity, Diophantine equations and arithmetic functions.

MATH 410 Advanced Calculus I (3)
Prerequisites: MATH 240; and MATH 241. First semester of a year course. Subjects covered during the year are: sequences and series of numbers, continuity and differentiability of real valued functions of one variable, the Rieman integral, sequences of functions, and power series. Functions of several variables including partial derivatives, multiple integrals, line and surface integrals. The implicit function theorem.

MATH 411 Advanced Calculus II (3)
Prerequisites: MATH 410; and MATH 240 or MATH 400. Continuation of MATH 410.

MATH 414 Differential Equations (3)
Prerequisites: MATH 410; and MATH 240 or equivalent. Existence and uniqueness theorems for initial value problems. Linear theory: fundamental matrix solutions, variation of constants

formula, Floquet theory for periodic linear systems. Asymptotic orbital and Lyapunov stability with phase plane diagrams. Boundary value theory and series solutions.

MATH 415 Introduction to Partial Differential Equations (3)
Prerequisites: MATH 246; and [MATH 411 or MATH 251]. MATH 411 and MATH 415 may be taken concurrently. Credit will be granted for only one of the following: MATH 415 or MATH 462. First order equations, linear second order equations in two variables, one dimensional wave equation and the method of separation of variables, and other topics such as harmonic functions, the heat equation, and the wave equation in space.

MATH 417 Introduction to Fourier Analysis (3)
Prerequisite: MATH 410. Fourier series. Fourier and Laplace transforms.

MATH 430 Euclidean and Non-Euclidean Geometries (3)
Prerequisite: MATH 141. Hilbert's axioms for Euclidean geometry. Neutral geometry: the consistency of the hyperbolic parallel postulate and the inconsistency of the elliptic parallel postulate with neutral geometry. Models of hyerbolic geometry. Existence and properties of isometries.

MATH 432 Introduction to Point Set Topology (3)
Prerequisite: MATH 410 or equivalent. Connectedness, compactness, transformations, homomorphisms; application of these concepts to various spaces, with particular attention to the Euclidean plane.

MATH 433 Introduction to Algebraic Topology (3)
Prerequisites: MATH 403; and MATH 432, or equivalent. Chains, cycles, homology groups for surfaces, the fundamental group.

MATH 436 Introduction to Differential Geometry (3)
Prerequisites: MATH 241; and [MATH 240 or MATH 461] or equivalent. The differential geometry of curves and surfaces, curvature and torsion, moving frames, the fundamental differential forms, intrinsic geometry of a surface.

MATH 444 Elementary Logic and Algorithms (3)
Prerequisite: MATH 240. Also offered as CMSC 450. An elementary development of propositional logic, predicate logic, set algebra, and Boolean algebra, with a discussion of Markov algorithms, Turing machines and recursive functions. Topics include post productions, word problems, and formal languages.

MATH 446 Axiomatic Set Theory (3)
Prerequisite: MATH 403 or MATH 450. Development of a system of axiomatic set theory, choice principles, induction principles, ordinal arithmetic including discussion of cancellation laws, divisibility, canonical expansions, cardinal arithmetic including connections with the axiom of choice, Hartog's theorem, Konig's theorem, properties of regular, singular, and inaccessible cardinals.

MATH 447 Introduction to Mathematical Logic (3)
Prerequisite: MATH 403 or MATH 410 or MATH 450. Formal propositional logic, completeness, independence, decidability of the system, formal quantificational logic, first-order axiomatic theories, extended Godel completeness theorem, Lowenheim-Skolem theorem, model-theoretical applications.

MATH 461 Linear Algebra for Scientists and Engineers (3)
Prerequisites: MATH 141 and one MATH/STAT course for which MATH 141 is a prerequisite. This course cannot be used toward the upper level math requirements for MATH/STAT majors. Credit will be granted for only one of the following: MATH 240, MATH 400 or MATH 461. Basic concepts of linear algebra. This course is similar to MATH 240, but with more extensive

coverage of the topics needed in applied linear algebra: change of basis, complex eigenvalues, diagonalization, the Jordan canonical form.

MATH 462 Partial Differential Equations For Scientists and Engineers (3)
Prerequisites: MATH 241; and MATH 246. Credit will be granted for only one of the following: MATH 462 or MATH 415. Linear spaces and operators, orthogonality, Sturm-Liouville problems and eigenfunction expansions for ordinary differential equations, introduction to partial differential equations, including the heat equation, wave equation and Laplace's equation, boundary value problems, initial value problems, and initial-boundary value problems.

MATH 463 Complex Variables for Scientists and Engineers (3)
Prerequisite: MATH 241 or equivalent. The algebra of complex numbers, analytic functions, mapping properties of the elementary functions. Cauchy integral formula. Theory of residues and application to evaluation of integrals. Conformal mapping.

MATH 464 Transform Methods For Scientists and Engineers (3)
Prerequisites: MATH 246; and MATH 463. Fourier series, Fourier and Laplace transforms. Evaluation of the complex inversion integral by the theory of residues. Applications to ordinary and partial differential equations of mathematical physics: solutions using transforms and separation of variables. Additional topics such as Bessel functions and calculus of variations.

MATH 472 Methods and Models in Applied Mathematics I (3)
Prerequisite: [MATH 241; and MATH 246; and MATH 240; and PHYS 161 or PHYS 171] or permission of department. Recommended: one of: MATH 410, MATH 414, MATH 415, MATH 462, MATH 463 or PHYS 262, PHYS 273. Also offered as MAPL 472. Credit will be granted for only one of the following: MATH 472 and MAPL 472. Mathematical models in fluid dynamics and elasticity, both linear and non-linear partial differential equations, variational characterizations in eigenvalue problems, numerical algorithms. Additional optional topics as time permits. Some examples are Hamiltonian systems, Maxwell's equations, non-linear programming.

MATH 473 Methods and Models in Applied Mathematics II (3)
Prerequisite: MATH 472 or permission of department. Also offered as MAPL 473. Credit will be granted for only one of the following: MATH 473 and MAPL 473. Continuation of the two semester sequence MATH 472 and MATH 473.

MATH 475 Combinatorics and Graph Theory (3)
Prerequisites: MATH 240; and MATH 241. Also offered as CMSC 475. General enumeration methods, difference equations, generating functions. Elements of graph theory, matrix representations of graphs, applications of graph theory to transport networks, matching theory and graphical algorithms.

MATH 478 Selected Topics For Teachers of Mathematics (1-3)
Prerequisite: one year of college mathematics or permission of department. (This course cannot be used toward the upper level math requirements for MATH/STAT majors).

MATH 498 Selected Topics in Mathematics (1-9)
Honors students register for reading courses under this number. *Repeatable to 9 credits if content differs.* Topics of special interest to advanced undergraduate students will be offered occasionally under the general guidance of the departmental committee on undergraduate studies.

MATH 600 Abstract Algebra I (3)
Prerequisite: MATH 405 or equivalent. Groups with operators, homomorphism and isomorphism theorems, normal series, Sylow theorems, free groups, Abelian groups, rings, integral domains, fields, modules. If time permits, HOM (A,B), Tensor products, exterior algebra.

MATH 601 Abstract Algebra II (3)
Prerequisite: MATH 600. Field theory, Galois theory, multilinear algebra. Further topics from: Dedekind domains, Noetherian domains, rings with minimum condition, homological algebra.

MATH 602 Homological Algebra (3)
Prerequisite: MATH 600. Projective and injective modules, homological dimensions, derived functors, spectral sequence of a composite functor. Applications.

MATH 603 Commutative Algebra (3)
Prerequisite: MATH 600. Ideal theory of Noetherian rings, valuations, localizations, complete local rings, Dedekind domains.

MATH 606 Algebraic Geometry I (3)
Prerequisite: MATH 600 and MATH 601. Prime and primary ideals in Noetherian rings, Hilbert Nullstellensatz, places and valuations, prevarieties (in the sense of Serre), dimension, morphisms, singularities, varieties, schemes, rationality.

MATH 607 Algebraic Geometry II (3)
Prerequisite: MATH 606. Topics in contemporary algebraic geometry chosen from among: theory of algebraic curves and surfaces, elliptic curves, Abelian varieties, theory of schemes, theory of zeta functions, formal cohomology, algebraic groups, reduction theory.

MATH 608 Selected Topics in Algebra (1-3)
Prerequisite: permission of instructor.

MATH 620 Algebraic Number Theory I (3)
Prerequisite: MATH 601. Algebraic numbers and algebraic integers, algebraic number fields of finite degree, ideals and units, fundamental theorem of algebraic number theory, theory of residue classes, Minkowski's theorem on linear forms, class numbers, Dirichlet's theorem on units, relative algebraic number fields, decomposition group, inertia group and ramification group of prime ideals with respect to a relatively Galois extension.

MATH 621 Algebraic Number Theory II (3)
Prerequisites: MATH 600; and MATH 620 or equivalent. Valuation of a field, algebraic function fields, completion of a valuation field, ramification exponent and residue class degree, ramification theory, elements, differents, discriminants, product formula and characterization of fields by the formula, Gauss sum, class number formula of cyclotomic fields.

MATH 630 Real Analysis I (3)
Prerequisite: MATH 411 or equivalent. Lebesque measure and the Lebesque integral on R, differentiation of functions of bounded variation, absolute continuity and fundamental theorem of calculus, Lp spaces on R, Riesz-Fisher theorem, bounded linear functionals on Lp, metric spaces, Baire category and uniform boundedness theorems.

MATH 631 Real Analysis II (3)
Prerequisite: MATH 630. Abstract measure and integration theory, Radon-Nikodym theorem, Riesz Representation theorem, Lebesque decomposition, Fubini's theorem, Banach and Hilbert spaces, Banach-Steinhaus theorem, topological spaces, Arzela-Ascoli and Stone- Weierstrass theorems, compact sets and Tychonoff's theorem.

MATH 632 Functional Analysis (3)
Prerequisite: MATH 631. Introduction to functional analysis and operator theory: normed linear spaces, basic principles of functional analysis, bounded linear operators on Hilbert spaces, spectral theory of selfadjoint operators, applications to differential and integral equations, additional topics as time permits.

MATH 634 Harmonic Analysis (3)
Prerequisite: MATH 631. L1 theory: Fejer theorem, inversion theorem, ideal structure, Tauberian theorem. L2 theory: Plancherel-Parseval theorems, Paley-Wiener theorem. Lp theory: Hausdorff-Young theorem. Distribution theory: Bochner's theorem, Wiener continuous measures theorem, Malliavin theorem, Schwartz theory, almost periodic functions.

MATH 636 Representation Theory (3)
Prerequisite: MATH 631. Introduction to representation theory of Lie groups and Lie algebras; initiation into non-abelian harmonic analysis through a detailed study of the most basic examples, such as unitary and orthogonal groups, the Heisenberg group, Euclidean motion groups, the special linear group. Additional topics from the theory of nilpotent Lie groups, semisimple Lie groups, p-adic groups or C*-algebras.

MATH 642 Dynamical Systems I (3)
Prerequisites: MATH 432; and MATH 630 or equivalent. Foundations of topological dynamics, homeomorphisms, flows, periodic and recurrent points, transitivity and minimality, symbolic dynamics. Elements of ergodic theory, invariant measures and sets, ergodicity, ergodic theorems, mixing, spectral theory, flows and sections. Applications of dynamical systems to number theory, the Weyl theorem, the distribution of values of polynomials, Vander Waerden's theorem on arithmetic progressions.

MATH 643 Dynamical Systems II (3)
Prerequisite: MATH 642 or equivalent. Entropy theory, variational principle for the entropy, expansiveness, measures with maximal entropy. Smooth systems on manifolds, diffeomorphisms and flows, periodic points, stable and unstable manifolds, homoclinic points, transversality, the Krupka-Smale theorem, Morse-Smale systems. Hyperbolicity, Anosov systems, distributions and foliations, strange attractors, Bowen's measure.

MATH 648 Selected Topics in Analysis (1-3)
Prerequisite: permission of instructor.

MATH 654 Non-linear Elasticity (3)
Prerequisite: permission of instructor. Fundamentals of non-linear elasticity. Finite deformations, rubber elasticity, small deformations superimposed on finite deformations.

MATH 655 Asymptotic Analysis and Special Functions I (3)
Prerequisite: MATH 413 or MATH 463. Also offered as MAPL 655. Transcendental equations, Gamma function, orthogonal polynomials, Bessel functions, integral transforms, Watson's lemma, Laplace's method, stationary phase, analytic theory of ordinary differential equations, Liouville-Green (or WKBJ) approximation.

MATH 656 Asymptotic Analysis and Special Functions II (3)
Prerequisite: MATH/MAPL 655. Also offered as MAPL 656. Steepest descents, coalescing saddle-points, singular integral equations, irregular singularities, Bessel, hypergeometic, and Legendre functions, Euler-Maclaurin formula, Darboux's method, turning points, phase shift.

MATH 660 Complex Analysis I (3)
Prerequisite: MATH 410 or equivalent. Linear transformations, analytic functions, conformal mappings, Cauchy's theorem and applications, power series, partial fractions and factorization, elementary Riemann surfaces, Riemann's mapping theorem.

MATH 661 Complex Analysis II (3)
Prerequisites: MATH 630; and MATH 660. Topics in conformal mappings, normal families, Picard's theorem, classes of univalent functions, extremal properties, variational methods, elliptic functions, Riemann surfaces.

MATH 668 Selected Topics in Complex Analysis (1-3)
Repeatable if content differs. Prerequisite: permission of instructor. Material selected to suit interests and background of the students. Typical topics: Kaehler geometry, automorphic functions, several complex variables, symmetric spaces.

MATH 669 Selected Topics in Riemann Surfaces (1-3)
Prerequisite: permission of instructor. Repeatable if content differs. Construction of Riemann surfaces, hyperbolic geometry, Fuchsian and Kleinian groups, potential theory, uniformisation

spaces of meromorphic functions, line bundles, Picard variety, Riemann-Roch, Teichmueller theory.

MATH 670 Ordinary Differential Equations I (3)
Prerequisites: MATH 405; and MATH 410 or the equivalent. Also offered as MAPL 670. Existence and uniqueness, linear systems usually with Floquet theory for periodic systems, linearization and stability, planar systems usually with Poincare-Bendixson theorem.

MATH 671 Ordinary Differential Equations II (3)
Prerequisites: MATH 630; and MATH/MAPL 670 or the equivalent. Also offered as MAPL 671. The content of this course varies with the interests of the instructor and the class. Stability theory, control, time delay systems, Hamiltonian systems, bifurcation theory, and boundary value problems, and the like.

MATH 673 Classical Methods in Partial Differential Equations I (3)
Prerequisite: MATH 410 or equivalent. Also offered as MAPL 673. Cauchy problem for the wave equation and heat equation, Dirichlet and Neumann problem for Laplace's equation. Classification of equations, Cauchy-Kowaleski theorem. General second order linear and nonlinear elliptic and parabolic equations.

MATH 674 Classical Methods in Partial Differential Equations II (3)
Prerequisite: MATH 673. Also offered as MAPL 674. General theory of first order partial differential equations, characteristics, complete integrals, Hamilton-Jacobi theory. Hyperbolic systems in two independent variables, existence and uniqueness, shock waves, applications to compressible flow.

MATH 680 Eigenvalue and Boundary Value Problems I (3)
Prerequisites: MATH 405; and MATH 410 or equivalent. Also offered as MAPL 680. Operational methods applied to ordinary differential equations. Introduction to linear spaces, compact operators in Hilbert space, study of eigenvalues.

MATH 681 Eigenvalue and Boundary Value Problems II (3)
Prerequisite: MATH/MAPL 680. Also offered as MAPL 681. Boundary value problems for linear partial differential equations. Method of energy integrals applied to Laplace's equation, heat equations and the wave equations. Study of eigenvalues.

MATH 682 Variational Methods (3)
The Euler-Lagrange equation, minimal principles in mathematical physics, estimation of capacity, torsional rigidity and other physical quantities; symmetrization, isoperimetric inequalities, estimation of eigenvalues, the minimax principle.

MATH 685 Modern Methods in Partial Differential Equations I (3)
Prerequisites: MATH 630; and MATH 631. Also offered as MAPL 685. Spaces of distributions, Fourier transforms, concept of weak and strong solutions. Existence, uniqueness and regularity theory for elliptic and parabolic problems, methods of functional analysis.

MATH 686 Modern Methods in Partial Differential Equations II (3)
Prerequisite: MATH/MAPL 685. Also offered as MAPL 686. Emphasis on nonlinear problems. Sobolev embedding theorems, methods of monotonicity, compactness, applications to elliptic, parabolic and hyperbolic problems.

MATH 710 Consistency Proofs in Set Theory (3)
Prerequisites: MATH 446; and MATH 447. Consistency and independence of such fundamental principles of set theory as the laws of choice, of cardinal arithmetic of constructability and regularity. Godel's model of constructible sets, inner models, Cohen's generic models.

MATH 712 Mathematical Logic I (3)
Sentential logic, first-order languages, models and formal deductions. Basic model theory including completeness and compactness theorems, other methods of constructing models, and applications such as non-standard analysis.

MATH 713 Mathematical Logic II (3)
Prerequisite: MATH 712 or MATH 447. Incompleteness and undecidability results of Godel, Church, Tarski and others. Recursive function. Basic proof theory and axiomatic set theory.

MATH 715 Model Theory (3)
Prerequisite: MATH 712. Topics to be covered include the compactness theorem and Lowenheim-Skolem theorems for first-order logic. 'Omega'-completeness theorem, ultra products, saturated and special models, definability results, categoricity in power, omitting types of elements, and applications to algebra and analysis.

MATH 716 Recursive Function Theory (3)
Prerequisite: MATH 713. Topics to be covered are formal definitions of computability and recursive functions, Kleenes' enumeration and fixed-point theorems, Turing reducibility, the arithmetical hierarchy. Other topics are simple and hypersimple sets, truth-table reducibility, creative sets, Myhill's theorem in one-one reducibility, deficiency sets, Friedberg's solution of Post's problem, maximal sets, retraceable sets, major subsets, the analytical hierarchy, recursive ordinals, hyper arithmetical sets.

MATH 718 Selected Topics in Mathematical Logic (1-3)
Prerequisite: permission of instructor.

MATH 730 Fundamental Concepts of Topology (3)
Prerequisites: [MATH 410; and MATH 411; and MATH 403] or equivalent. Survey of basic point set topology, fundamental group, covering spaces, Van Kampen's theorem, simplicial complexes, simplicial homology, Euler characteristics and classification of surfaces.

MATH 734 Algebraic Topology (3)
Prerequisite: MATH 403 or equivalent. Recommended: MATH 730. Singular homology and cohomology, cup products, Poincare duality, Eilenberg-Steenrod axioms, Whitehead and Hurewicz theorems, universal coefficient theorem, cellular homology.

MATH 740 Riemannian Geometry (3)
Prerequisites: [MATH 405; and MATH 411] or equivalent. Manifolds, tangent vectors and differential forms, Riemannian metrics, connections, curvature, structure equations, geodesics, completeness, immersions, tensor algebra, Lie derivative.

MATH 742 Differential Topology (3)
Prerequisites: [MATH 410; and MATH 411] or equivalent. Inverse and implicit function theorems, Sard's theorem, orientability, degrees, smooth vector bundles, imbeddings and immersions, transversality approximation theorems and applications, isotopy extension theorem, tubular neighborhoods.

MATH 744 Lie Groups I (3)
Prerequisite: [MATH 403; MATH 405; MATH 411 and MATH 432] or equivalent. An introduction to the fundamentals of Lie groups, including some material on groups of matrices and Lie algebras.

MATH 745 Lie Groups II (3)
Prerequisite: MATH 744. A continuation of Lie groups I in which some of the following topics will be emphasized: solvable Lie groups, compact Lie groups, classifications of semi-simple Lie groups, representation theory, homogeneous spaces.

MATH 748 Selected Topics in Geometry and Topology (1-3)
Prerequisite: permission of instructor.

MATH 799 Master's Thesis Research (1-6)

MATH 899 Doctoral Dissertation Research (1-8)

MEES – Marine-Estuarine-Environmental Sciences

MEES 440 Essentials of Toxicology (2)
Prerequisite: BCHM 261 or BCHM 461. Principles involved in the assessment of responses of organisms to toxic chemicals, including systemic and organ toxicology, carcinogenesis, teratogenesis, and consideration of the effects of major groups of toxicants.

MEES 498 Topics in Marine-Estuarine-Environmental Sciences (1-4)
Lecture and/or laboratory series organized to study a selected area of marine-estuarine-environmental sciences not otherwise considered in formal courses.

MEES 608 Seminar in Marine-Estuarine-Environmental Sciences (1-2)

MEES 611 Systems Ecology of Estuaries (3)
Prerequisites: calculus and ZOOL 470 or ZOOL 480. A broad systems perspective on the important components and processes of estuarine ecosystems, with quantitative and/or mathematical treatment toward development of representative models for estuarine dynamics.

MEES 621 Ecology of Estuarine and Marine Environments (3)
Population and community ecology of estuarine and marine systems. Coastal and estuarine processes are emphasized in the context of the oceans in general.

MEES 631 Ecology of Estuarine Microbes I (5)
Two lectures and one three-hour laboratory daily during Summer Session. *Prerequisite: introductory course in each of botany, microbiology and zoology, as well as ecology, physiology, and systematics from one of the disciplines.* Basic conceptual treatment of estuarine microbial interactions with emphasis on the algae, protozoa, bacteria and viruses of the Chesapeake Bay. The laboratory will stress observation and experimentation with collected material. Field and shipboard experience are included. Offered during summer session only.

MEES 632 Ecology of Estuarine Microbes II (1-5)
Pre- or corequisite: MEES 631. Schedule by arrangement with instructor. Directed research on problems of estuarine microbial interactions.

MEES 641 Environmental Toxicology (3)
Prerequisite: permission of instructor. The introduction, behavior, fate, and effects of chemicals in the environment; organisms in the atmosphere, hydrosphere, and lithosphere and the effects of foreign chemicals and other stresses on their health and well-being.

MEES 642 Laboratory Methods in Toxicology (1-2)
One lecture and one three-hour laboratory per week. *Pre- or corequisites: MEES 641 or ENTM 653 or permission of instructor.* A methodology and techniques course designed to give the student experience in toxicological research. The first half of the course may be taken for one credit and will emphasize methods useful to entomologists.

MEES 661 Physics and Geology of Estuarine and Marine Environments (3)
Emphasis on physical and geological estuarine processes in the context of the oceans as a whole: geomorphology and evolution of ocean basins and continental margins, composition of sea water and geochemical balance, circulation, and sedimentation.

MEES 681 Coastal Resource Use, Law and Management: The Chesapeake (3)
An interdisciplinary course drawing on resource economics, political science and law to examine the natural resources of the Chesapeake and the market, political and legal processes through

which Chesapeake resource use decisions result. The course is designed to provide social and natural scientists with an understanding of coastal use and management issues.

MEES 698 Special Topics in Marine-Estuarine-Environmental Sciences (1-4)
Credit according to time schedule and course organization. Lecture and/or laboratory series organized to study selected areas of environmental science not otherwise considered by existing courses. May be repeated for credit since topic coverage will change.

MEES 699 Special Problems in Marine-Estuarine-Environmental Sciences (1-3)
Research on specialized topics under the direction of individual faculty members.

MEES 721 Plankton Dynamics (3)
Prerequisite: MEES 621; and MEES 661 or equivalent. Physiological ecology of plankton populations beginning with the biochemistry, physiology and ecology of phytoplankton and concluding with the physiology and ecology of zooplankton.

MEES 743 Aquatic Toxicology (3)
Two lectures and three four-hour laboratories per week. One all day field trip. *Prerequisites: MEES 641; and BCHM 462 or permission of instructor.* Lectures and laboratory exercises on the chemical and biological principles involved in the design of experiments in aquatic toxicology. Analytical techniques needed to measure chemicals in toxicological studies. The design of acute and chronic bioassays. Chemical and biological phenomena which control or alter the responses of aquatic organisms to chemicals in bioassay.

MEES 799 Masters Thesis Research (1-6)

MEES 899 Doctoral Dissertation Research (1-8)

METO – Meteorology

METO 400 The Atmosphere (3)
Prerequisites: CHEM 103; and MATH 241; and MATH 246; and PHYS 263. The atmosphere and its weather and climate systems. Composition of the atmosphere, energy sources and sinks, winds, storms, global circulation. The application of basic classical physics, chemistry, and mathematics to the study of the atmosphere.

METO 401 Global Environment (3)
Prerequisite: METO 400. The global weather and climate system; the natural variability of the atmosphere-ocean-biosphere. Potential human effects: greenhouse effects, deforestation, acid rain, ozone depletion, nuclear winter. Social, political and economic effects of changes in global environment. Policy options.

METO 434 Air Pollution (3)
Prerequisites: [CHEM 113 and MATH 241] or permission of department. Production, transformation, transport and removal of air pollutants. The problems of photochemical smog, the greenhouse effect, stratospheric ozone, acid rain, and visibility. Analytical techniques for gases and particles.

METO 499 Special Problems in Atmospheric Science (1-3)
Prerequisite: permission of department. Repeatable to 6 credits. Research or special study in the field of meteorology and the atmospheric and oceanic sciences.

METO 600 Synoptic Meteorology I (3)
Pre- or corequisites: METO 610; and METO 620. Observational approach to the atmosphere, the nature of storms, and the techniques of forecasting, including the use of numerical guidance.

METO 601 Synoptic Meteorology II (3)
Prerequisite: METO 600. Weather forecasting using numerical and statistical models. Prediction on the global, synoptic, meso, and local scales.

METO 610 Dynamic Meteorology I (3)
Pre- or corequisite: MATH 462. The equations of atmospheric motion and their elementary applications; circulation and vorticity; planetary boundary layer; diagnostic analysis with the quasi-geostrophic equations; atmospheric oscillations; baroclinic instability and dynamics of mid-latitude systems; the atmospheric energy cycle; the general circulation of troposphere and stratosphere.

METO 611 Dynamic Meteorology II (3)
Prerequisite: METO 610. Atmospheric oscillations: wave motion and stability analysis; geostrophic adjustment; energy propagation. Planetary fluid dynamics: dynamics of Hadley and Walker circulations; barotropic and baroclinic instability; dynamics of the tropical atmosphere; stationary waves; multiple equilibria.

METO 612 Atmospheric Turbulence and Diffusion (3)
Prerequisite: METO 610. Basic turbulence theory; the statistical description of turbulence; the profiles of temperature and wind near the ground and the vertical transports of momentum, heat, and water vapor; spectra and scales of atmospheric turbulence; diffusion theory and turbulent dispersion models applied to the atmosphere.

METO 614 Numerical Weather Prediction (3)
Prerequisite: METO 611 or equivalent. Numerical techniques for the solution of partial differential equations; application to the equations of atmospheric motion; Eulerian, Lagrangian and spectral methods; numerical models of the general circulation; current applications to research and forecasting.

METO 616 Planetary Fluid Dynamics (3)
Prerequisites: METO 610; and METO 620. The structure of the atmospheres of the earth and other planets; analytical, numerical and experimental models of the circulations of planetary atmospheres and oceans; tidal motions.

METO 617 General Circulation of the Atmosphere (3)
Prerequisite: METO 610. Equations for mean axially symmetric and asymmetric fields of atmospheric motion; observed circulations; budget of heat, momentum and water vapor; energetics; simplified solutions of mean axially symmetric and asymmetric fields of motion; numerical simulation of general circulation.

METO 620 Physical Meteorology I (3)
Prerequisite: MATH 461. Atmospheric thermodynamics. The microphysics of cloud formation and precipitation.

METO 621 Physical Meteorology II - Atmospheric Radiation (3)
Prerequisites: MATH 462; and METO 620. Concepts and definitions of radiant energy; radiation absorption and scattering the atmosphere; techniques for calculating the transfer of solar and terrestrial radiation in the atmosphere, the planetary radiation budget.

METO 625 Remote Inference of Atmospheric Properties by Satellite (3)
Prerequisites: METO 621; and MATH 461. Weather satellite programs and instrumentation. Radiative transfer applied to satellite observations. Physical basis of remote inference. Temperature and moisture soundings. Errors in satellite retrievals. Applications to numerical weather simulation and prediction.

METO 630 Statistical Methods in Meteorology (3)
Prerequisite: STAT 400 or equivalent. Tests of significance; time series analysis; analysis of variance; multiple regression and screening multiple regression; representation of meteorological field variables by orthogonal polynomials and empirical orthogonal polynomials.

METO 637 Atmospheric Chemistry (3)
Prerequisites: CHEM 481 or METO 620. Application of the techniques of thermodynamics, kinetics, spectroscopy and photochemistry to atmospheric gases and particles. Investigation of

the global cycles of C, H, O, N, and S species; the use of laboratory and field measurements in computer models of the atmosphere.

METO 640 Micrometeorology (3)
Prerequisites: (MATH 461; and METO 621) or permission of instructor. Microscale surface/atmosphere interactions and their parameterization, current observational results, computational techniques for momentum, heat and water vapor transfer in the surface boundary layer.

METO 646 Atmospheric Optics (3)
Prerequisite: METO 620. Quantitative assessment of radiative energy transfers in the atmosphere; absorption and scattering by atoms, molecules and particulates; emission by excited species. Spectroscopic analysis methods; laser assay of atmosphere for natural species and pollutants.

METO 658 Special Topics in Meteorology (1-3)
Prerequisite: permission of instructor. Various special topics in meteorology are given intensive study. The topic of concentration varies, from semester to semester and depends on student and faculty interests. Often, specialists from other institutions are invited to the campus on a visiting lectureship basis to conduct the course.

METO 671 Air-Sea Interaction (3)
Prerequisite: MATH 462. Corequisite: METO 610. Observations and theories of the seasonal changes in the ocean circulation and temperature, and interactions with the atmosphere. Equations of motion and theories of wind-driven circulation. Mixed layer observations and theories. Midlatitude and equatorial waves. Seasonal budgets of momentum, fresh water, and heat. El Nino/Southern Oscillation. Interannual variability and atmosphere-ocean coupling.

METO 799 Master's Thesis Research (1-6)

METO 899 Doctoral Dissertation Research (1-8)

MICB – Microbiology

Some of these courses may require the use of animals. See the statement on Animal Care and Use in the appendix and the policy statement for students under degree requirements.

MICB 400 Systematic Microbiology (2)
Prerequisite: 8 credits in microbiology. History and philosophy of classification. Alpha, numerical and molecular genetic taxonomy. Methods used in microbial identification and classification.

MICB 410 History of Microbiology (1)
Prerequisite: MICB major. History and integration of the fundamental discoveries of the science. Modern aspects of abiogenesis, fermentation, and disease causation in relation to early theories.

MICB 420 Epidemiology and Public Health (2)
Prerequisite: MICB 200. History, characteristic features of epidemiology; the important responsibilities of public health; vital statistics.

MICB 430 Marine Microbiology (2)
Prerequisite: MICB 200. Morphology, biochemistry and ecology of marine microorganisms including fungi, yeasts, bacteria and viruses. Properties of marine bacteria, such as luminescence, metal ion requirements for growth, production of ectocrine compounds, and sampling and culturing marine microorganisms.

MICB 431 Marine Microbiology Laboratory (3)
One lecture and two three-hour laboratory periods per week. *Prerequisites: MICB 200 and permission of the instructor.* Morphology, biochemistry and ecology of marine microorganisms. Properties of marine bacteria; luminescence, metal ion requirements, ectocrine compound production, sampling and culturing. Laboratory may include sampling trips in Chesapeake Bay and a deep sea research cruise.

MICB 440 Pathogenic Microbiology (4)
Two hours of lecture and four hours of laboratory per week. *Prerequisite: MICB 200.* The role of bacteria and fungi in the diseases of humans with emphasis upon the differentiation and culture of microorganisms, types of disease, modes of disease transmission, prophylactic, therapeutic, and epidemiological aspects.

MICB 450 Immunology (4)
Two hours of lecture and four hours of laboratory per week. *Prerequisite: MICB 440. Credit will be granted for only one of the following: ZOOL 455 or MICB 450.* Principles of immunity; hypersensitiveness. Fundamental techniques of immunology.

MICB 453 Recombinant DNA Laboratory (3)
Pre- or corequisite: course in "Recombinant DNA". Credit will be granted for only one of the following: MICB 453 or ZOOL 453. An advanced course offering hands-on experience in performing recombinant DNA experiments. Techniques required for cloning procaryotic genes in Escherichia coli.

MICB 460 General Virology (3)
Prerequisite: MICB 440 or equivalent. Discussion of the physical and chemical nature of viruses, virus cultivation and assay methods, virus replication, viral diseases with emphasis on the oncogenic viruses, viral genetics, and characteristics of the major virus groups.

MICB 470 Microbial Physiology (3)
Prerequisite: MICB 200. Pre- or corequisite: BCHM 462. Microbial cellular and population growth. Fermentation metabolism, physiology of anaerobiosis, and energy conservation and transformation in bacterial membranes. Efficiency of energy utilization for growth. Membrane structure and transport. Bacterial chemotaxis. Regulation of bacterial chromosome replication, RNA and protein synthesis. Control of metabolic pathways.

MICB 480 Microbial Ecology (3)
Prerequisites: MICB 200; and CHEM 243 or CHEM 245. Interaction of microorganisms with the environment, other microorganisms and with higher organisms. Roles of microorganisms in the biosphere. Microorganisms and current environmental problems.

MICB 490 Microbial Fermentations (3)
Prerequisite: MICB 470. Study of fermentative metabolism in bacteria and yeasts; primary and secondary metabolites; culture and medium development; mass cultivation of microorganisms; industrial processes for organic solvents, acids, amino acids, antibiotics; bioconversions; immobilized enzyme and cell reactors; special problems with genetically engineered cultures.

MICB 491 Microbial Fermentations Laboratory (2)
Four hours of laboratory per week. *Pre- or corequisite: MICB 490.* Second semester. Methods for the conduct, control and analysis of fermentation processes.

MICB 674 Bacterial Metabolism (2)
Prerequisite: MICB 470 or equivalent; and BCHM 462. Central pathways of bacterial energy and biosynthetic metabolism. Bacterial fermentations, diversity of aerobic metabolism, metabolic regulation, chemolithotrophic and phototrophic metabolism. Salvage pathways of purine and pyrimidine metabolism, and occasional current topics.

MICB 688 Special Topics (1-4)
First semester. *Prerequisite: twenty credits in microbiology.* Presentation and discussion of fundamental problems and special subjects in the field of microbiology.

MICB 714 Cytology of Bacteria (2)
A colloquium for graduate students in biological sciences covering structure-function relationships in bacteria. Formal presentations are required.

MICB 750 Advanced Immunology (2)
Second semester. Antigens, antibodies, and their interactions. Research fundamentals in immunology and immunochemistry.

MICB 751 Immunology Laboratory (2)
Six hours of laboratory per week. Second semester. Techniques in experimental immunology and immunochemistry.

MICB 760 Virology and Tissue Culture (2)
Prerequisite: MICB 440 or equivalent. Second semester. Physical, chemical and biological properties of viruses; viral replication; major virus groups.

MICB 761 Virology and Tissue Culture Laboratory (2)
Six hours of laboratory per week. *Prerequisite: MICB 440 or equivalent and permission of instructor.* Second semester. Laboratory methods in virology with emphasis on cell culture techniques.

MICB 780 Genetics of Microorganisms (2)
Prerequisite: BCHM 461; and BCHM 462 or equivalent. First semester. An introduction to genetic principles and methodology applicable to microorganisms.

MICB 781 Microbial Genetics Laboratory (2)
Six hours of laboratory per week. Two three-hour laboratory meetings per week. A laboratory course designed to acquaint students with the techniques employed in studying gene control of microbial activities.

MICB 788 Seminar (1)
First semester.

MICB 789 Seminar (1)
Second semester.

MICB 799 Master's Thesis Research (1-6)

MICB 899 Doctoral Dissertation Research (1-8)

MUED – Music Education

MUED 410 Instrumental Arranging (2)
Prerequisites: MUSC 250 and permission of department. Arranging for school bands and orchestras from the elementary through high school levels.

MUED 411 Instrumental Music: Methods and Materials For the Elementary School (3)
A comprehensive study of instructional materials and teaching techniques for beginning instrumental classes--winds, strings and percussion.

MUED 420 Instrumental Music: Methods, Materials and Administration for Secondary School (2)
A comprehensive study of instructional and program materials, rehearsal techniques and program planning for junior and senior High School bands and orchestras. Organization, scheduling, budgeting and purchasing are included.

MUED 438 Special Problems in the Teaching of Instrumental Music (2-3)
Prerequisite: MUSC 113-213 or the equivalent. A study, through practice on minor instruments, of the problems encountered in public school teaching of orchestral instruments. Literature and teaching materials, minor repairs, and adjustment of instruments are included. The course may be taken for credit three times since one of four groups of instruments: strings, woodwind, brass or percussion will be studied each time the course is offered.

MUED 450 Music in Early Childhood Education (3)
Prerequisite: MUSC 155 or equivalent. Creative experiences in songs and rhythms, correlation of music and everyday teaching with the abilities and development of each level; study of songs and materials; observation and teaching experience with each age level.

MUED 470 General Concepts For Teaching Music (1)
Corequisite: MUED 411 or MUED 471. Basic philosophical, psychological, educational considerations for a total music program K-12; strategies for teaching tonal and rhythmic concepts; evaluation techniques and field experiences in designated schools.

MUED 471 Methods For Teaching Elementary General Music (3)
A study of curriculum, materials, and teaching techniques for the development of meaningful music experiences which contribute to a sequential musical growth for children in the elementary schools.

MUED 472 Choral Techniques and Repertoire (2)
Prerequisites: MUED 470 and MUSC 490. Rehearsal techniques for developing appropriate diction, tone, production, intonation, phrasing, and interpretation of choral music; examination of a wide variety of repertoire for use by choral performing groups on the elementary and secondary levels.

MUED 478 Special Topics in Music Education (1-2)
Prerequisite: MUED 470 or permission of department. Repeatable to 5 credits. Each topic focuses on a specific aspect of the music instructional program; collectively, the topics cover a wide range of subject matter relevant to today's schools.

MUED 499 Workshops, Clinics, Institutes (2-6)
Innovative and experimental dimensions of music education will be offered to meet the needs of music teachers and music supervisors and to allow students to individualize their programs. The maximum number credits that may be earned under this course symbol toward any degree is six semester hours; the symbol may be used two or more times until six semester hours have been reached.

MUED 637 Advanced Study: Developing Musicality Through Instrumental Music (3)
Analysis of new and established methods and materials for developing musicality. The study of the curriculum for large and small ensembles, and class instruction, and its adaptation to the diverse organizations of today's schools.

MUED 662 Advanced Study: Developing Musicality in Children (3)
Analysis of new and established methods and materials including Orff and Kodaly, and their adaptation to teaching music in the diverse organizations of today's elementary schools. Emphasis on general musical experiences for all children.

MUED 672 Advanced Study: Developing Musicality in the Adolescent (3)
Analysis of new and established methods and materials for developing musicality through classes in general music, music appreciation, music in the humanities, music theory, chorus, small ensembles, and class voice.

MUED 674 Choral Conducting and Repertoire (3)

MUED 690 Research Methods in Music and Music Education (3)
The application of methods of research to problems in the fields of music and music education. The preparation of bibliographies and the written exposition of research projects in the area of the student's major interest.

MUED 692 Foundations of Music Education (3)
Educational thought and its application to instruction and evaluation in music education.

MUED 698 Current Trends in Music Education (2-4)
A survey of current and emerging philosophies, methodologies and curricula in music education and their implementation. The influence of educational and social changes and the expanding musical scene upon the music programs for children of all ages and for teacher education. The maximum number of credits that may be earned under this course symbol (within established

limits of programs) toward any degree, eight semester hours. The symbol may be used two or more times until eight semester hours have been completed.

MUSC – Music

MUSC 400 Music Pedagogy (3)
Pre- or corequisite: MUSC 418 or a more advanced course in applied music. Conference course. A study of major pedagogical treatises in music, and an evaluation of pedagogical techniques, materials, and procedures.

MUSC 415 Music Management (3)
Prerequisite: permission of department. Application of management concepts to music administration.

MUSC 428 Repertoire Coaching of Vocal or Chamber Music (2)
Pre- or corequisite: MUSC 328. A course for piano students who wish to go further than the work offered in MUSC 128, MUSC 228, and MUSC 328 by becoming specialists in the areas of vocal coaching or chamber music coaching. Elements of pedagogy, conducting, and responsible artistic decision-making for the entire musical production.

MUSC 429 Opera Theater (2-3)
10 hours of laboratory per week. Open to music and non-music majors with permission of department. Repeatable to 12 credits. Advanced techniques of operatic production; preparation, rehearsal, and performance of operatic works from both the traditional and contemporary repertory.

MUSC 432 Music in World Cultures I (3)
Prerequisite: MUSC 130 or permission of department. Asian musics from Japan to the Arab countries analyzed in terms of musical, social and aesthetic approaches.

MUSC 433 Music in World Cultures II (3)
Prerequisite: MUSC 130 or permission of department. Music of the Balkans, Africa, South and North America analyzed in terms of musical, social and aesthetic interrelationships.

MUSC 436 Jazz: Then and Now (3)
Major styles and influential artists of the past 75 years of jazz.

MUSC 438 Area Studies in Ethnomusicology (3)
Prerequisite: MUSC 432 or MUSC 433 or equivalent. Repeatable to 9 credits if content differs. Advanced study of musics in selected regions of the world.

MUSC 439 Collegium Musicum (1)
Prerequisite: permission of department. Repeatable to 5 credits. Open to undergraduates and graduates, music majors and non-majors. Procurement, edition, and performance of music not belonging to a standard repertory: early music, compositions for unusual performing media, works which demand reconstruction of their original circumstances of performance. Outcome of a semester's work may be one or more performances for the public.

MUSC 443 Solo Vocal Literature (3)
Prerequisite: MUSC 330, MUSC 331 or equivalent. The study of solo vocal literature from the Baroque Cantata to the Art Song of the present. The Lied, Melodie, vocal chamber music, and the orchestral song are examined.

MUSC 445 Survey of the Opera (3)
Prerequisite: MUSC 330, MUSC 331 or equivalent. A study of the music, librettos and composers of the standard operas.

MUSC 448 Selected Topics in Music (1-3)
Prerequisite: permission of department. A maximum of three credits may be applied to music major requirements. 56 semester hours. Repeatable to 6 credits if content differs.

MUSC 450 Musical Form (3)
Prerequisite: MUSC 251. A study of the principles of organization in music with emphasis on eighteenth and nineteenth century European music. Reading and analysis of scores exemplifying the musical forms.

MUSC 451 Analysis of Music (3)
Prerequisite: MUSC 450 or permission of department. An advanced course in the analysis of tonal music. Discussion of individual works, with emphasis on their unique characteristics and on the relation of analysis to performance.

MUSC 452 Keyboard Harmony (2)
Prerequisite: MUSC 251. Keyboard performance of musical score for vocal and instrumental ensembles and keyboard realization of basso continuo parts.

MUSC 453 Class Study of Guitar and Recorder (2)
Three hours of laboratory per week. Prerequisite: permission of department. Study and development of instrumental technique, pedagogical practices, and materials relating to group performance.

MUSC 457 Electronic Music Composition (2)
Prerequisite: MUSC 250 and permission of department. Theory and practice of electronic music, electronically-generated sound, and its modulation in the voltage-controlled studio.

MUSC 460 Tonal Counterpoint I (2)
Prerequisite: MUSC 251 or permission of department. A course in eighteenth-century contrapuntal techniques, analysis and original composition of two-voice dances, preludes, and inventions.

MUSC 461 Tonal Counterpoint II (2)
Prerequisite: MUSC 460. A continuation of MUSC 460. Analysis and original composition of larger works displaying imitation in more than two voices, including the chorale prelude and fugue.

MUSC 462 Modal Counterpoint (2)
Prerequisite: MUSC 251 or equivalent. An introduction to the contrapuntal techniques of the sixteenth century: the structure of the modes, composition of modal melodies, and contrapuntal writing for two, three and four voices.

MUSC 465 Canon and Fugue (3)
Prerequisite: MUSC 461 or equivalent. Composition and analysis of the canon and fugue in the styles of the eighteenth, nineteenth and twentieth centuries.

MUSC 466 Structural Counterpoint (3)
Prerequisite: MUSC 461 or permission of department. A study of counterpoint and its role in articulating large-scale tonal structures with emphasis on analysis and written exercises.

MUSC 467 Piano Pedagogy I (3)
A study of major pedagogical treatises in music, and an evaluation of pedagogical techniques, materials, and procedures.

MUSC 468 Piano Pedagogy II (3)
Prerequisite: MUSC 467. Repeatable to 6 credits. Application of the studies begun in MUSC 467 to the actual lesson situation. Evaluation of results.

MUSC 470 Harmonic and Contrapuntal Practices of the Twentieth Century (2)
Prerequisite: MUSC 251 or equivalent. A theoretical and analytical study of twentieth century materials.

MUSC 471 Contemporary Compositional Techniques (2)
Prerequisite: MUSC 470 of permission of department. Continuation of MUSC 470, with emphasis on the analysis of individual works written since 1945.

MUSC 480 Music in Antiquity and the Middle Ages (3)
Survey of western music from Hellenic times to 1450.

MUSC 481 Music in the Renaissance (3)
Survey of western music from 1450 to 1600.

MUSC 482 Music in the Baroque Era (3)
Survey of western music from 1600 to 1750.

MUSC 483 Music in the Classic Era (3)
Survey of western music from 1750 to 1820.

MUSC 484 Music in the Romantic Era (3)
Survey of western music from 1820 to 1900.

MUSC 485 Music in the 20th Century (3)
Survey of western music from 1900 to the present.

MUSC 486 Orchestration I (2)
Prerequisite: MUSC 251. A study of the ranges, musical functions and technical characteristics of the instruments and their color possibilities in various combinations. Practical experience in orchestrating for small and large ensembles.

MUSC 487 Orchestration II (2)
Prerequisite: MUSC 486. A study of orchestration in the various historical periods, with emphasis upon stylistic writing projects.

MUSC 490 Conducting (2)
Prerequisite: MUSC 251. Vocal and instrumental baton techniques.

MUSC 491 Conducting II (2)
Prerequisite: MUSC 490 or equivalent. Baton techniques applied to score reading, rehearsal techniques, tone production, style and interpretation.

MUSC 492 Keyboard Music I (3)
The history and literature of harpsichord and solo piano music from its beginning to the romantic period. Emphasis is placed on those segments of repertory which are encountered in performance and teaching situations at the present time.

MUSC 493 Keyboard Music II (3)
Prerequisite: MUSC 492. The history and literature of harpsichord and solo piano music from the Romantic period to the present. Emphasis is placed on those segments of repertory which are encountered in performance and teaching situations at the present time.

MUSC 494 Survey of Theory (3)
Prerequisite: MUSC 251. A study of the major contributions of music theorists from Greek antiquity through the twentieth century.

MUSC 495 Acoustics For Musicians (3)
Prerequisite: MUSC 251 or equivalent; and senior or graduate standing in music. The basic physics of music, acoustics of musical instruments and music theory, physiological acoustics, and musico-architectural acoustics.

MUSC 499 Independent Studies (2-3)
Prerequisite: permission of department. May be repeated once for credit. Independent research on a topic chosen in consultation with the instructor, which may culminate in a paper or appropriate project.

MUSC 608 Chamber Music Repertory (1-3)
May be repeated for credit to the maximum credit designated in the student's major degree program. *Prerequisite: graduate standing as a major in performance.* A study, through performance, of diversified chamber music for standard media.

MUSC 621 Documents of Theory and Aesthetics: Ancient, Medieval and Renaissance (3)
Writings about music in antiquity, the Middle Ages, and the Renaissance.

MUSC 622 Documents of Theory and Aesthetics: Baroque (3)
Writings about western music from 1600 to 1750.

MUSC 623 Documents of Theory and Aesthetics: Classic (3)
Writings about western music from 1750 to 1820.

MUSC 624 Documents of Theory and Aesthetics: Romantic (3)
Writings about western music from 1820 to 1900.

MUSC 625 Documents of Theory and Aesthetics: 20th Century (3)
Writings about western music from 1900 to the present.

MUSC 630 Teaching the Theory, History, and Literature of Music (3)
Prerequisite: graduate standing and permission of instructor. A course in teaching methodology with emphasis on instruction at the college level.

MUSC 635 American Music (3)
Prerequisite: permission of department. A survey of American art music from Colonial times to present.

MUSC 639 Seminar in Music (3)
Prerequisite: MUSC 330 and MUSC 331 and permission of instructor. Repeatable if content differs. The work of one major composer (Bach, Beethoven, etc.) will be studied.

MUSC 640 Performance Practice I (3)
Problems in the performance of music lying primarily outside the standard repertory. Mainly for performance majors.

MUSC 641 Performance Practice II (3)
Problems in the performance of music lying primarily outside the standard repertory. Mainly for performance majors. Continuation of MUSC 640.

MUSC 642 Early Music Notation (3)
Aspects of notation in music before 1600; transcription into modern notation.

MUSC 643 Seminar in Solo Vocal Literature I (3)
Preerquisite: MUSC 444 or equivalent. An intensive study of solo vocal literature from its origin to the present.

MUSC 644 Seminar in Solo Vocal Literature II (3)
Prerequisite: MUSC 643 or equivalent. A continuation of MUSC 643 with an emphasis on areas of individual interest.

MUSC 645 Seminar in Vocal Pedagogy (3)
Prerequisite: MUSC 400 or equivalent. A study of the physiological, psychological and acoustical aspects of the teaching of singing combined with independent study and research in areas of individual interest.

MUSC 648 Seminar in Music Research (3)
Prerequisite: MUSC 331 and graduate standing. An introduction to graduate study in the history and literature of music. Bibliography and methodology of systematic and historical musicology.

MUSC 650 The Contemporary Idiom (3)
Prerequisite: MUSC 470 or permission of department. Analysis of various works of the twentieth century.

MUSC 662 Advanced Modal Counterpoint (3)
Prerequisite: MUSC 461 or permission of department. Composition of music in the style of the Renaissance. Analysis of the music of such composers as Ockeghem, Dufay, Josquin, Palestrina.

MUSC 670 Advanced Analytical Techniques I (3)
Prerequisite: MUSC 451 or permission of department. Analysis of representative masterpieces of the eighteenth and early nineteenth centuries.

MUSC 671 Advanced Analytical Techniques II (3)
Prerequisite: MUSC 451 or permission of department. Analysis of representative masterpieces of the nineteenth and early twentieth centuries.

MUSC 675 Music Theory Pedagogy (3)
Analysis of introductory level music theory courses, evaluation of text materials, and teaching approaches for music fundamentals, aural training, and basic undergraduate theory programs.

MUSC 678 Seminar in Musical Composition (3)
Prerequisite: MUSC 479 or equivalent; and graduate standing. An advanced course in musical composition. May be repeated for credit.

MUSC 679 Seminar in Ethnomusicology (3)
Prerequisite: MUSC 434 and MUSC 435. Selected problems in Ethnomusicology. Independent research in such topics as transcription, analysis, and taxonomy.

MUSC 680 Seminar in Music of Antiquity and the Middle Ages (3)
Research topics in music from antiquity to 1450.

MUSC 681 Seminar in Music of the Renaissance (3)
Seminar in music of the Renaissance. Research topics in music from 1450 to 1600.

MUSC 682 Seminar in Music of the Baroque Era (3)
Seminar in music of the Baroque era. Research topics in music from 1600 to 1750.

MUSC 683 Seminar in Music of the Classic Era (3)
Seminar in music of the Classic era. Research topics in music from 1750 to 1820.

MUSC 684 Seminar in Music of the Romantic Era (3)
Seminar in music of the Romantic era. Research topics in music from 1820 to 1900.

MUSC 685 Seminar in Music of the 20Th Century (3)
Seminar in music of the twentieth century. Research topics in music from 1900 to the present.

MUSC 688 Advanced Orchestration (3)
Prerequisite: MUSC 487 or equivalent, and graduate standing. May be repeated for credit. Orchestration projects in the styles of Debussy, Ravel, Stravinsky, Schoenberg, Bartok, and others.

MUSC 689 Advanced Conducting (3)
Prerequisite: MUSC 491 or equivalent. May be repeated for credit. A concentrated study of the conducting techniques involved in the repertoire of all historical periods.

MUSC 699 Selected Topics in Music (1-3)
Prerequisite: permission of department. A maximum of three credits may be applied to degree requirements. Repeatable to 6 credits if content differs.

MUSC 799 Master's Thesis Research (1-6)

MUSC 800 Advanced Seminar in Music Pedagogy (3)
Prerequisites: MUSC 400 or equivalent, doctoral standing and permission of instructor. A detailed study of historical and contemporary methods of pedagogy, and analysis of pedagogical problems. Sectioning by instrument. Required of all candidates for the D.M.A. Degree in performance and literature.

MUSC 801 Advanced Seminar in Music Pedagogy (3)
Prerequisites: MUSC 400 or equivalent, doctoral standing and permission of instructor. A detailed study of historical and contemporary methods of pedagogy, and analysis of pedagogical problems. Sectioning by instrument. Required of all candidates for the D.M.A. Degree in performance and literature.

MUSC 830 Doctoral Seminar in Music Literature (3)
Prerequisite: at least twelve hours in music history and literature. An analytical survey of the literature of music: keyboard music; vocal music; string music; wind instrument music; required of all candidates for the D.M.A. Degree in literature-performance.

MUSC 831 Doctoral Seminar in Music Literature (3)
Prerequisite: MUSC 830 or permission of instructor. An analytical survey of the literature of music: keyboard music; vocal music; string music; wind instrument music. Required of all candidates for the D.M.A. Degree in literature-performance.

MUSC 878 Advanced Composition (3)
Prerequisite: MUSC 678 or equivalent, and permission of instructor. Repeatable for credit. Conference course in composition in the larger forms.

MUSC 899 Doctoral Dissertation Research (1-8)

MUSP – Music Performance

Graduate music performance courses are available in three series:
minor series - MUSP 402, 403 intended for either music majors studying a secondary instrument or non-music majors.

principal series - MUSP 409,410,609,610 intended for majors in music programs other than performance.

major series MUSP 419,420,619,620,719,815,816,817 intended for students majoring in performance.

variable credit courses: may be taken for 2 or 4 credits. Instrument designation: each student taking a music performance course must indicate the instrument chosen by adding a suffix to the proper course number, such as: MUSP 402A music performance - piano. A—piano; B—voice; C--violin; D—viola; E—cello; F—bass; G—flute; H—oboe; I—clarinet; J—basson; K—saxophone; L—horn; M—trumpet; N—trombone; O—tuba; P—euphonium; Q—percussion; R—organ; S—guitar; T—composition; U—conducting; V—harp; W—electronic composition; X—hist inst - keyboard; Y—hist inst - strings; Z—hist inst - winds.

400-LEVEL courses in the minor series: *prerequisite: permission of department chairperson.* Each course in the series must be taken in sequence. One half-hour private lesson per week plus assigned independent practice.

400-LEVEL courses in the principal or major series: 2 or 4 credits. *Prerequisite: permission of the department chairperson. Each course in the series must be taken in sequence. One-hour private lesson per week plus assigned independent practice.*

MUSP 402 Music Performance (2)
Senior course, in the minor series.

MUSP 403 Music Performance (2)
Senior course, in the minor series.

MUSP 409 Music Performance (2-4)
Senior course in the principal series.

MUSP 410 Music Performance (2-4)
Senior course in the principal series. Recital required.

MUSP 419 Music Performance (2-4)
Senior course in the major series.

MUSP 420 Music Performance (2-4)
Senior course in the major series. Recital required.

MUSP 609 Interpretation and Repertoire (2)
Prerequisite: permission of department chairman and graduate standing in performance in the principal series.

MUSP 610 Graduate Music Performance (4)
Prerequisite: MUSP 609 and permission of department chairman. Recital course in the principal series.

MUSP 619 Interpretation and Repertoire (2-4)
Prerequisite: departmental audition and permission of Department Chairman. Repeatable to a maximum of 12 credits.

MUSP 620 Graduate Music Performance (4)
Prerequisite: MUSP 619 and permission of Department Chairman. Recital course in the major series.

MUSP 719 Interpretation and Repertoire (2-4)
Prerequisite: departmental audition, admission to doctoral program in the major series and permission of department chairman. Repeatable to a maximum of 12 credits.

MUSP 815 Interpretation, Performance, and Pedagogy (4)
A seminar in pedagogy and the pedagogical literature for the doctoral performer, with advanced instruction at the instrument, covering appropriate compositions. Required of all candidates for the D.M.A. Degree in literature-performance. *Prerequisite: doctoral standing in performance and permission of department chairman. Recital course.*

MUSP 816 Interpretation, Performance, and Pedagogy (4)
Recital course. *Prerequisite: MUSP 815 and permission of Department Chairman.*

MUSP 817 Interpretation, Performance, and Pedagogy (4)
Recital course. *Prerequisite: MUSP 816 and permission of Department Chairman.*

NRMT – Natural Resources Management

NRMT 411 Biology and Management of Shellfish (4)
Two hours of lecture and six hours of laboratory per week. *Prerequisite: one year of biology or zoology. Formerly AGRI 411.* Identification, biology, management, and culture of commercially important molluscs and crustacea. The shellfisheries of the world, with emphasis on those of the northwestern Atlantic Ocean and the Chesapeake Bay. Field trips.

NRMT 460 Principles of Wildlife Management (3)
Three hours of lecture per week. Three Saturday field trips are scheduled. *Prerequisite: two semesters of laboratory biology.* Ecological principles and requirements of wildlife as bases for management, and introduction to the scientific literature. Conflicts in wildlife management, government administration of wildlife resources, legislation, and history of the wildlife management profession.

NRMT 461 Urban Wildlife Management (3)
Two lectures per week. Two Saturday field trips are scheduled. Ecology and management of wildlife in urban areas. For students in biological sciences, geography, landscape design, natural resources management, recreation and urban studies. Planning, design, and wildlife conservation in landscape ecology. Public attitudes, preferences, and values, reviews of private conservation organizations.

NRMT 470 Natural Resources Management (4)
Senior standing. For NRMT majors only. Field work, and independent research on watersheds. Intensive seminar on resource management planning and report preparation.

NRMT 487 Conservation of Natural Resources I (3)
Formerly AEED 487. Designed primarily for teachers. Study of state's natural resources: soil, water, fisheries, wildlife, forests and minerals; natural resources problems and practices. Exten-

sive field study. Concentration on subject matter. Taken concurrently with NRMT 497 in summer season.

NRMT 489 Field Experience (1-4)
Prerequisite: permission of department. Repeatable to 6 credits. Formerly AEED 489. Planned field experience for both major and non-major students.

NRMT 497 Conservation of Natural Resources II (3)
Formerly AEED 497. Designed primarily for teachers. Study of state's natural resources: soil, water, fisheries, wildlife, forests and minerals; natural resources problems and practices. Extensive field study. Methods of teaching conservation included. Taken concurrently with NRMT 487 in summer season.

NRMT 499 Special Problems (3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs.

NUSC – Nutritional Sciences

NUSC 402 Fundamentals of Nutrition (3)
Prerequisites: CHEM 104; and ANSC 212. Recommended: BCHM 261. A study of the fundamental role of all nutrients in the body including their digestion, absorption, and metabolism. Dietary requirements and nutritional deficiency syndromes of laboratory and farm animals and man.

NUSC 425 International Nutrition (3)
Prerequisite: course in basic nutrition. Nutritional status of world population and local, national, and international programs for improvement.

NUSC 450 Advanced Human Nutrition II (4)
Two hours of lecture and three hours of laboratory per week. *Prerequisites: permission of department; NUTR 300; and BCHM 261 or concurrent registration in BCHM 462.* A critical study of physiological and metabolic influences on utilization of water soluble vitamins and minerals. Consideration of nutrition and the life cycle, with emphasis on current problems in human nutrition.

NUSC 460 Therapeutic Human Nutrition (4)
Three hours of lecture and two hours of laboratory per week. Prerequisite: NUTR 440 and NUTR 450. Also offered as NUTR 460. Modifications of the normal adequate diet to meet human nutritional needs in acute and chronic diseases and metabolic disorders.

NUSC 603 Mineral Metabolism (3)
Two hours of lecture and two hours of discussion/recitation per week. *Prerequisites: BCHM 461; and BCHM 462.* Presentation of basic nutritional data on mineral metabolism with emphasis on interactions of minerals. Trace elements will be given special attention. The role of minerals in metabolic regulation is stressed.

NUSC 604 Vitamin Nutrition (3)
Two hours of lecture and two hours of discussion/recitation per week. *Prerequisites: ANSC 401 and BCHM 461.* Advanced study of the fundamental role of vitamins and vitamin-like cofactors in nutrition including chemical properties, absorption, metabolism, excretion and deficiency syndromes. A critical study of the biochemical basis of substances and of certain laboratory techniques.

NUSC 612 Energy Nutrition (2)
Prerequisites: NUSC 402 or NUSC 450; and BCHM 461. Second semester. Basic concepts of animal energetics with quantitative descriptions of energy requirements and utilization.

NUSC 663 Advanced Nutrition Laboratory (3)
One hour of lecture and six hours of laboratory per week. *Prerequisites: ANSC 401/NUSC 401; and either BCHM 462 or NUSC 670. Also offered as ANSC 663.* Basic instrumentation and

techniques desired for advanced nutritional research. The effect of various nutritional parameters upon intermediary metabolism, enzyme kinetics, endocrinology, and nutrient absorption in laboratory animals.

NUSC 670 Intermediary Metabolism in Nutrition (3)
Prerequisites: BCHM 461; and BCHM 462; or equivalent. Also offered as NUTR 670. Second semester. The major routes of carbohydrate, fat and protein metabolism with particular emphasis on metabolic shifts and their detection and significance in nutrition.

NUSC 680 Human Nutritional Status (3)
Two hours of lecture and three hours of laboratory per week. *Prerequisites: Advanced Nutrition, Biochemistry and Physiology.* Indirect and direct methods of appraisal of human nutritional status which include: dietary, anthropometric, clinical evaluations and biochemical measures.

NUSC 698 Seminar in Nutrition (1-3)
First and second semesters. In depth study of a selected phase of nutrition.

NUSC 699 Problems in Nutrition (1-4)

NUSC 799 Master's Thesis Research (1-6)
First and second semesters. Work assigned in proportion to amount of credit. Students will be required to pursue original research in some phase of nutrition, carrying the same to completion, and reporting the results in the form of a thesis.

NUSC 898 Colloquium in Nutrition (1)
First and second semesters. Oral reports on special topics or recently published research in nutrition. Distinguished scientists are invited as guest lecturers. A maximum of three credits allowed for the M.S.

NUSC 899 Doctoral Dissertation Research (1-8)
First and second semesters. Work assigned in proportion to amount of credit. Students will be required to pursue original research in some phase of nutrition, carrying the same to completion, and reporting the results in the form of a dissertation.

NUTR – Nutrition

Some of these courses may require the use of animals. See the statement on Animal Care and Use in the appendix and the policy statement for students under degree requirements.

NUTR 425 International Nutrition (3)
Prerequisite: course in basic nutrition. Nutritional status of world populations; consequences of malnutrition on health and mental development; and local, national, and international programs for nutritional improvement.

NUTR 440 Advanced Human Nutrition I (4)
Three hours of lecture and three hours of laboratory per week. *Prerequisites: (NUTR 330; and ZOOL 202; and NUTR l00 or NUTR 200) or permission of department.* A critical study of physiological and metabolic influences on utilization of carbohydrates, lipids, protein and fat soluble vitamins, with particular emphasis on current problems in human nutrition.

NUTR 450 Advanced Human Nutrition II (4)
Three hours of lecture and three hours of laboratory per week. *Prerequisites: NUTR 440 or permission of department.* A critical study of physiological and metabolic influences on utilization of water soluble vitamins and minerals. Consideration of nutrition and the life cycle, with emphasis on current problems in human nutrition.

NUTR 460 Therapeutic Human Nutrition (4)
Three hours of lecture and two hours of laboratory per week. *Prerequisites: NUTR 440 and NUTR 450. Also offered as NUSC 460.* Modifications of the normal adequate diet to meet human nutritional needs in acute and chronic diseases and metabolic disorders.

NUTR 468 Practicum in Nutrition (1-6)
Prerequisite: permission of department. Repeatable to 6 credits. Inservice training and practical experience in the application of the principles of normal and/or therapeutic nutrition in an approved community agency, clinical facility or nutrition research laboratory.

NUTR 470 Community Nutrition (3)
Prerequisites: NUTR 440 or permission of department. A study of nutrition education principles and techniques for use with children and adults; program development, implementation, and evaluation; community nutrition programs and problems.

NUTR 475 Dynamics of Community Nutrition (3)
Prerequisite: NUTR 470 or permission of department. The practice of community nutrition. Community assessment; nutrition program planning, implementation and evaluation; nutrition education and counseling; grantsmanship; and the legislative process.

NUTR 490 Special Problems in Nutrition (2-3)
Prerequisite: NUTR 440 and permission of department. Individual selected problems in the area of human nutrition.

NUTR 498 Selected Topics (1-3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs. Selected current aspects of nutrition.

NUTR 615 Maternal and Infant Nutrition (3)
Prerequisite: NUTR 460 or equivalent, or permission of department. Current literature concerning the importance of diet during pregnancy and infancy on the health of the mother and infant. Physiological and biochemical changes during pregnancy and infancy, current issues in infant feeding, such as possible effects of diet during infancy on obesity and degenerative diseases in later life, and current public health programs designed to serve pregnant women and infants.

NUTR 620 Nutrition for Community Services (3)
Application of the principles of nutrition to various community problems of specific groups of the public. Students may select specific problems for independent study.

NUTR 625 Nutritional Needs of the Developmentally Disabled (2)
Prerequisite: NUTR 460 or equivalent. An analysis of the handicapping conditions resulting from abnormal brain structure, maturation or function and the effects on nutritional status. Assessment techniques, requirements and treatment approaches.

NUTR 630 Nutritional Aspects of Energy Balance (3)
Prerequisite: NUTR 450 or equivalent; or permission of department. The prevalence and basic causes of caloric imbalance, along with a wide variety of approaches to weight control.

NUTR 635 Carbohydrates, Lipids and Proteins in Human Nutrition (3)
Prerequisite: NUTR 450 or equivalent. Current literature concerning recent developments in the area of carbohydrates, lipids and proteins in human nutrition. Application of research findings to clinical and community settings.

NUTR 645 Vitamin and Mineral Nutrition in Humans (3)
Prerequisite: NUTR 450 or equivalent. Current literature concerning recent developments in the areas of vitamin and mineral metabolism. Emphasis on interactions of these nutrients and clinical applications of current research.

NUTR 650 Nutritional Needs of Women (2)
Prerequisite: NUTR 450 or equivalent. Current literature concerning areas of nutrition that have special impact on women during the various stages of the life cycle. Examination of nutrient requirements from a hormonal perspective with an emphasis on the alteration of nutritional needs with hormonal contraceptives.

NUTR 655 Nutrition, Food and Public Policy (3)
Prerequisites: NUTR 450 or equivalent; and permission of department. History and current status of legislation relative to nutrition and food. Focus on gaining insights and skills regarding working effectively in the area of nutrition and public policy.

NUTR 660 Research Methods (3)
Prerequisite: a statistics course. A study of appropriate research methodology and theories including experimental design. Each student is required to develop a specimen research proposal.

NUTR 670 Intermediary Metabolism in Nutrition (3)
Prerequisites: BCHM 461; and BCHM 462; or equivalent. Also offered as NUSC 670. The major routes of carbohydrate, fat, and protein metabolism with particular emphasis on metabolic shifts and their detection and significance in nutrition.

NUTR 675 Advanced Clinical Dietetics (3)
Prerequisite: permission of department. A study and application of principles and theories of normal and therapeutic nutrition to assess, plan, implement, evaluate and improve the total nutritional care of hospitalized and ambulatory patients. Open to Walter Reed dietetic interns only.

NUTR 678 Selected Topics in Nutrition (1-6)
Repeatable to 6 credits if content differs. Individual or group study in an area of nutrition.

NUTR 680 Human Nutritional Status (3)
Two hours of lecture and three hours of laboratory per week. *Prerequisite: advanced nutrition, biochemistry and physiology.* Indirect and direct methods of appraisal of human nutritional status which include: dietary, anthropometric, clinical evaluations and biochemical measures.

NUTR 688 Seminar in Nutrition (1-3)
Repeatable to 3 credits if content differs. A study in depth of a selected phase of nutrition.

NUTR 699 Problems in Nutrition (1-4)
Prerequisite: permission of department. Repeatable to 4 credits. Experience in a phase of nutrition of interest to the student. Use is made of experimental animals, human studies and extensive, critical studies of research methods, techniques or data of specific projects.

NUTR 789 Non-Thesis Research (1-3)
Directed graduate study which forms the basis of a non-thesis research paper.

NUTR 799 Master's Thesis Research (1-6)

NUTR 888 Doctoral Seminar (1)
Prerequisite: permission of department. Discussion of current research related to nutrition. Presentations by doctoral students, faculty and visiting speakers.

NUTR 899 Doctoral Dissertation Research (1-8)

PCOM – Public Communication

PCOM 700 Introduction to Doctoral Study in Public Communication (3)
Prerequisite: admission to PCOM program. Basic skills in public communication research. Exploration of the interdisciplinary content of public communication. Modes of inquiry in the disciplines of broadcasting, film, journalism, speech communication and theatre.

PCOM 701 Quantitative Methods in Public Communication Research (3)
Prerequisite: PCOM 700. Logic and methods of quantitative data collection and statistical analysis as applied to communication studies. Research strategies for communication: experimentation, survey research, field research, and content analysis.

PCOM 702 Intermediate Quantitative Data Analysis in Public Communication Research: The General Linear Model (3)
Prerequisite: PCOM 700 and permission of instructor. Data analysis in current public communication research. Techniques include regression, correlation, factor analysis, matrix algebra,

covariance structure, and path diagrams. Students will be expected to have completed a methods course and a statistics course or tested equivalent competencies.

PCOM 703 Advanced Quantitative Data Analysis in Public Communication Research: Structural Equation Models (3)
Prerequisite: PCOM 702; and permission of instructor. Model evaluation and theory construction in communication. Causal systems in current public communication research: recursive, nonrecursive, and unobserved variable models. Students must have a dissertation research project requiring quantitative methods.

PCOM 711 Qualitative Research Methods in Public Communication Research (3)
Prerequisite: PCOM 700. Methods for historical, critical, and field research in public communication. Formulation of significant research questions, systematic collection of bibliographic and phenomenal information, formulating substantial claims, organizing and writing research for disciplinary outlets.

PCOM 712 Advanced Historical/Critical Methods in Public Communication Research (3)
Prerequisite: PCOM 711; and permission of instructor. Critical assessment of qualitative approaches to public communication. Introduction to significant schools of historical and critical research. Advanced techniques for inquiry and manuscript preparation. Students must have a dissertation research project requiring historical or critical method.

PCOM 888 Doctoral Practicum in Public Communication (3-9)
Repeatable to 9 credits. Critical analysis of a phase of a professional field of public communication. Analysis of professional activity through personal observation. Evaluation of the purpose, process, effectiveness, and efficiency of professional activity. Recommendations for training and further research.

PCOM 889 Doctoral Tutorial in Public Communication (3-8)
Individual research in public communication. Repeatable to a maximum of nine credits.

PCOM 899 Doctoral Dissertation Research (1-8)

PERH – Physical Education, Recreation, and Health

PERH 488 Children's Health and Development Clinic (1-4)
Prerequisite: permission of department. Repeatable to 4 credits. An opportunity to acquire training and experience in a therapeutically oriented physical education—recreation program for children referred by various education, special education, medical or psychiatric groups.

PERH 615 Crises of Aging: Time, Retirement and Widowhood (3)
A cross-disciplinary and multidisciplinary investigation of phenomena which comprise a significant portion of the issues confronting an older adult's life: (1) introduction to multiple processes of adulthood and aging; (2) the concepts and meaning of time; (3) pre-retirement and retirement adjustments; and (4) loss and widowhood.

PERH 625 Issues in Retirement: Theory and Practice (3)
Multidisciplinary examination of retirement phenomena, including theories of transition, government and private sector policies, social expectations, physical correlates, personal adjustments, and economic consequences. Emphasis upon research utilization.

PERH 688 Field Work in Aging (1-6)
Two hours of class plus ten hours of supervised field work per week. *Prerequisite: permission of department.* Sequences of supervised field experience in the field of aging including direct service, administration, research, or training. Emphasis on career exploration and assessment in relation to the field of aging.

PERH 689 Selected Problems in Health, Physical Education and Recreation (1-6)
Research projects in special areas in health, physical education and/or recreation which have interdisciplinary implications not covered in structured courses.

PERH 780 Interdisciplinary Issues in Aging (3)
Multidisciplinary approaches to the processes of aging to achieve a more holistic understanding. Pedagogical research dissemination, peer instruction, guest lecturing, and informal discussion. The demonstration of the multilateral nature of growing older. Discussion of cross-disciplinary and interdisciplinary research proposals.

PHIL – Philosophy

PHIL 408 Topics in Contemporary Philosophy (3)
Prerequisite: PHIL 320. Repeatable if content differs. An intensive examination of contemporary problems and issues. Source material will be selected from recent books and articles.

PHIL 412 The Philosophy of Plato (3)
Prerequisite: six credits in philosophy. A critical study of selected dialogues.

PHIL 414 The Philosophy of Aristotle (3)
Prerequisite: six credits in philosophy. A critical study of selected portions of Aristotle's writings.

PHIL 416 Medieval Philosophy (3)
Prerequisite: six credits in philosophy. A study of philosophical thought from the fourth to the fourteenth centuries. Readings selected from Christian, Islamic, and Jewish thinkers.

PHIL 421 The Continental Rationalists (3)
Prerequisite: six credits in philosophy. A critical study of selected writings of one or more of the continental rationalists.

PHIL 422 The British Empiricists (3)
Prerequisite: six credits in philosophy. A critical study of selected writings on one or more of the British Empiricists.

PHIL 423 The Philosophy of Kant (3)
Prerequisite: six credits in philosophy. A critical study of selected portions of Kant's writings.

PHIL 425 19th Century Philosophy (3)
Prerequisite: six credits in philosophy. A study of philosophy in the nineteenth century through an examination of such figures as Hegel, Marx, Kierkegaard, Nietzsche, and Mill.

PHIL 427 Wittgenstein (3)
Prerequisites: two courses in philosophy or permission of department. The early and late works of Wittgenstein: atomism, logic, and the picture theory in the Tractatus; roles, meaning, criteria, and the nature of mental states in the Philosophical Investigations and other posthumous writings.

PHIL 428 Topics in the History of Philosophy (3)
Prerequisites: PHIL 310 and PHIL 320; or permission of department. Repeatable if content differs.

PHIL 431 Aesthetic Theory (3)
Prerequisite: six credits in philosophy or permission of department. Study of the theory of the aesthetic as a mode of apprehending the world and of the theory of criticism, its conceptual tools and intellectual presuppositions.

PHIL 438 Topics in Philosophical Theology (3)
Prerequisite: PHIL 236 or consent of instructor. An examination of a basic issue discussed in theological writings, with readings drawn from both classical and contemporary theologians and philosophers. May be repeated to a maximum of six credits when the topics are different.

PHIL 440 Contemporary Ethical Theory (3)
Prerequisite: PHIL 341. Contemporary problems having to do with the meaning of the principal concepts of ethics and with the nature of moral reasoning.

PHIL 441 History of Ethics: Hobbes to the Present (3)
Prerequisite: one course in ethics. The history of ethical thought from the seventeenth century to the present, including such philosophers as Hobbes, Butler, Hume, Kant, Bentham, Mill, Bradley, Sidgwick, Moore, and Stevenson.

PHIL 442 Normative Ethical Theory (3)
Prerequisite: PHIL 341. A consideration of some of the main normative ethical theories.

PHIL 445 Political and Social Philosophy II (3)
Prerequisite: PHIL 245 or PHIL 341. A study of the main issues encountered in the philosophical analysis and evaluation of social and political institutions.

PHIL 446 Law, Morality, and War (3)
Prerequisite: GVPT 300, GVPT 401, PHIL 341, or permission of department. Also offered as GVPT 403. An exploration of fundamental moral and legal issues concerning war.

PHIL 447 Philosophy of Law (3)
Prerequisite: one course in philosophy. Examination of fundamental concepts related to law, e.g., legal system, law and morality, justice, legal reasoning, responsibility.

PHIL 450 Scientific Thought I (3)
Prerequisite: one course in philosophy or a major in science. The development of science, its philosophical interpretations and implications, and views of its methods, from the ancients through Newton and Leibniz.

PHIL 451 Scientific Thought II (3)
Prerequisite: one course in philosophy or a major in science. The development of science, its philosophical interpretations and implications, and views of its methods, from the death of Newton to the early twentieth century.

PHIL 452 Philosophy of Physics (3)
Prerequisite: three credits in philosophy or three credits in physics. Implications of 20th century physics for such problems as operationalism, the structure and purpose of scientific theories, the meaning of "probability", the basis of geometrical knowledge, the nature of space and time, the Copenhagen interpretation of quantum mechanics, the nature and limits of measurement. Emphasis on the interaction between physics and philosophy.

PHIL 453 Philosophy of Science II (3)
Prerequisite: PHIL 250, an upper-level course in philosophy, or a major in science. A comprehensive survey of developments in the main problems of the philosophy of science from logical positivism to the present. The nature of theories, models, laws, and counterfactuals, testing, inductive logic, and confirmation theory, experimental methodology, measurement, explanation, concept formation, growth of scientific knowledge, and scientific realism.

PHIL 455 Philosophy of the Social Sciences (3)
Prerequisite: PHIL 250, six hours in a social science, or permission of department. A consideration of philosophical issues arising in the social sciences, with particular emphasis on issues of practical methodological concern to social scientists.

PHIL 456 Philosophy of Biology (3)
Prerequisite: PHIL 250 or permission of department. Questions about concepts, reasoning, explanation, etc., in biology, and their relations to those of other areas of science. Case studies of selected aspects of the history of biology, especially in the twentieth century.

PHIL 457 Philosophy of History (3)
An examination of the nature of historical knowledge and historical explanation.

PHIL 458 Topics in the Philosophy of Science (3)
Prerequisite: PHIL 250 or permission of department; when the topic for a given semester demands, additional philosophical or scientific prerequisites may be required by the instructor. Repeatable to 6 credits if content differs. A detailed examination of a particular topic or problem in philosophy of science.

PHIL 461 Theory of Meaning (3)
Prerequisite: six credits in philosophy. Theories about the meaning of linguisitic expressions, including such topics as sense and reference, intentionality and necessity, and possible-world

semantics, through an examination of such writers as Mill, Frege, Wittgenstein, Quine, and Kripke.

PHIL 462 Theory of Knowledge (3)
Prerequisite: six credits in philosophy. Some central topics in the theory of knowledge, such as perception, memory, knowledge, and belief, skepticism, other minds, truth, and the problems of induction.

PHIL 464 Metaphysics (3)
Prerequisite: six credits in philosophy. A study of some central metaphysical concepts such as substance, identity, relations, causality, and time, and of the nature of metaphysical thinking.

PHIL 466 Philosophy of Mind (3)
Prerequisite: six credits in philosophy. An inquiry into the nature of mind through the analysis of such concepts as consciousness, thought, sensation, emotion, and desire. Consideration of mind-brain identity thesis.

PHIL 468 Topics in Philosophy of Language and Logic (3)
Prerequisite: one course in symbolic logic or permission of department. Repeatable to 9 credits if content differs. Problems in philosophy of language and/or philosophy of logic.

PHIL 471 Symbolic Logic II (3)
Prerequisite: PHIL 271 or permission of department. Axiomatic development of the propositional calculus and the first-order functional calculus, including the deduction theorem, independence of axioms, consistency, and completeness.

PHIL 472 Philosophy of Mathematics (3)
Prerequisite: PHIL 271 or permission of department. A study of results in foundations of mathematics and of philosophical views of the nature of mathematics and of mathematical knowledge.

PHIL 474 Induction and Probability (3)
Prerequisite: permission of department. A study of inferential forms, with emphasis on the logical structure underlying such inductive procedures as estimating and hypothesis-testing. Decision-theoretic rules relating to induction will be considered, as well as classic theories of probability and induction.

PHIL 478 Topics in Symbolic Logic (3)
Prerequisite: PHIL 471. Repeatable if content differs.

PHIL 480 Philosophy of Psychology: Knowledge and Reasoning (3)
Prerequisite: PHIL 380 or graduate status or permission of department. Cognitive science approaches to traditional problems in epistemology: rationality, reliability, computational models of belief revision.

PHIL 481 Philosophy of Psychology: Representation (3)
Prerequisite: PHIL 380 or graduate status or permission of department. Semantics and representations within computational framework: intentionality, explicit vs. implicit representation, syntax vs. semantics of thought, connectionist approaches, images, classical vs. prototype theories of concepts.

PHIL 482 Philosophy of Psychology: Subjectivity (3)
Prerequisite: PHIL 380 or graduate status or permission of department. The nature of subjectivity: problems of "point of view," the "qualities" or "feel" of things, emotions, consciousness whether these phenomena can be captured by a computational theory of mind.

PHIL 485 Philosophy of Neuroscience (3)
Prerequisite: (PHIL 250, or PHIL 380, or PHIL 455, or PHIL 456) or permission of department. Philosophical and methodological issues relating to brain science, including: the place of neuroscience in cognitive science, the nature of mental representation and processing in brains, bounded-resonance models in neuroanatomy and neurophysiology.

PHIL 487 Computer Science for Cognitive Studies (3)
Also offered as LING 487. Credit will be granted for only one of the following: PHIL 487 or LING 487. List processing and discrete mathematics. Preparation for the study of artificial intelligence and other mathematically oriented branches of cognitive studies. Intended for students of linguistics, philosophy, and psychology. LISP computer language, graphs and trees, the concept of computational complexity, search algorithms.

PHIL 488 Topics in Philosophy of Cognitive Studies (3)
Prerequisite: one course in philosophy or permission of department. Repeatable to 9 credits if content differs. Examination of a particular topic or problem in philosophy of cognitive studies.

PHIL 498 Topical Investigations (1-3)

PHIL 650 The History and Philosophy of Science and Technology (3)
Credit will be granted for only one of the following: PHIL 650 or HIST 606. Seminar in fundamental problems and current research in the history of science and technology; theories of historical change applied to selected cases in physical and biological science and in technology; historiographic and philosophical issues.

PHIL 688 Selected Problems in Philosophy (1-3)
Prerequisite: permission of instructor.

PHIL 788 Research in Philosophy (1-6)
Prerequisite: permission of advisor or chair of tutorial-advisory committee. Repeatable to 6 credits.

PHIL 799 Master's Thesis Research (1-6)

PHIL 808 Seminar in the Problems of Philosophy (3)
Prerequisite: permission of instructor.

PHIL 828 Seminar in the History of Philosophy (3)
Prerequisite: permission of instructor.

PHIL 838 Seminar in Aesthetics (3)
Prerequisite: permission of instructor.

PHIL 848 Seminar in Ethics (3)
Prerequisite: permission of instructor.

PHIL 858 Seminar in Logic and Philosophy of Sciences (3)
Prerequisite: permission of instructor.

PHIL 868 Seminar in Metaphysics (3)
Prerequisite: permission of instructor.

PHIL 869 Seminar in the Theory of Knowledge (3)
Prerequisite: permission of instructor.

PHIL 878 Proseminar in Cognitive Studies (3-9)
Prerequisite: permission of department. Repeatable to 9 credits if content differs. Methodology and research in various disciplines involved in cognitive studies.

PHIL 879 Seminar in Philosophy and Cognitive Studies (3)
Repeatable to 9 credits if content differs.

PHIL 899 Doctoral Dissertation Research (1-8)

PHYS – Physics

PHYS 406 Optics (3)
Prerequisite: [PHYS 263 or PHYS 273 or PHYS 301]; and MATH 240. Geometrical optics, optical instruments, wave motion, interference and diffraction, and other phenomena in physical optics.

PHYS 407 Sound (3)
Prerequisite: PHYS 142 or PHYS 263 or PHYS 273. Pre- or corequisite: MATH 246. Basic concepts of sound production and its applications.

PHYS 410 Elements of Theoretical Physics: Mechanics (4)
Prerequisite: [PHYS 263 or PHYS 273 or PHYS 301]; and MATH 241. Corequisite: MATH 240. Theoretical foundations of mechanics with extensive application of the methods. Various mathematical tools of theoretical physics.

PHYS 411 Elements of Theoretical Physics: Electricity and Magnetism (4)
Prerequisite: [PHYS 263 or PHYS 273 or PHYS 301]; and MATH 240 and MATH 241. Foundations of electromagnetic theory, with extensive applications of the methods. Thorough treatment of wave properties of solutions of Maxwell's equations.

PHYS 412 Kinetic Theory of Gases (3)
Prerequisite: PHYS 301 or PHYS 410; and MATH 240. Dynamics of gas particles, Maxwell-Boltzmann distribution, diffusion, Brownian motion, transport.

PHYS 414 Introduction to Thermodynamics and Statistical Mechanics (3)
Prerequisite: [PHYS 263 or PHYS 273 or PHYS 301]; and MATH 240. Introduction to basic concepts in thermodynamics and statistical mechanics.

PHYS 420 Principles of Modern Physics (3)
Prerequisite: [PHYS 263 or PHYS 273 or PHYS 301]; and MATH 241. Credit will be granted for only one of the following: PHYS 420 or PHYS 421. A survey of atomic and nuclear phenomena and the main trends in modern physics. Appropriate for students in engineering and other physical sciences.

PHYS 421 Introduction to Modern Physics (3)
Prerequisite: [PHYS 263 or PHYS 273 or PHYS 301]; and MATH 241, including some knowledge of ordinary equations. Credit will be granted for only one of the following: PHYS 420 or PHYS 421. Special relativity and origins of the quantum theory. Development of wave mechanics including angular momentum and the hydrogen spectrum.

PHYS 422 Modern Physics (4)
Prerequisite: PHYS 421. Use of quantum mechanics in a discussion of a variety of physical phenomena and systems, including atomic spectra, radioactivity, solid state phenomena, and the properties of elementary particles.

PHYS 423 Elementary Quantum Physics (3)
Prerequisites: PHYS 420 or 422; MATH 240 and 246; and a level of mathematical sophistication equivalent to that of a student who has taken PHYS 410 and 411, or ENEE 380 and 381. A rigorous presentation the quantum theory, including the concepts of operators, measurement and angular momentum. The application of these concepts together with the Schroedinger equation to some basic problems in atomic and molecular physics.

PHYS 429 Atomic and Nuclear Physics Laboratory (3)
Prerequisite: PHYS 395. Classical experiments in atomic physics and more sophisticated experiments in current techniques in nuclear physics.

PHYS 431 Properties of Matter (3)
Prerequisite: PHYS 301; or [PHYS 410 or PHYS 411]; and [PHYS 420 or PHYS 421]. Introduction to solid state physics. Electro-magnetic, thermal, and elastic properties of metals, semiconductors, insulators and superconductors.

PHYS 441 Nuclear Physics (3)
Prerequisite: PHYS 301: or [PHYS 410 and PHYS 411]; and [PHYS 420 or PHYS 421]. An introduction to nuclear physics at the pre-quantum-mech anics level. Properties of nuclei; radioactivity; nuclear systematics; nuclear moment; the Shell model, interaction of charged particles

and Gamma rays with matter; nuclear detectors; accelerators; nuclear reactions; Beta decay; high energy phenomena.

PHYS 443 Neutron Reactor Physics (3)
Prerequisite: PHYS 420 or PHYS 421 or consent of instructor. Various related topics in neutron reactor physics.

PHYS 451 Introduction to Elementary Particles (3)
Prerequisite: PHYS 422. Properties of elementary particles, production and detection of particles, relativistic kinematics, invariance principles and conservation laws.

PHYS 461 Introduction to Fluid Dynamics (3)
Prerequisite: PHYS 301 or PHYS 410; and MATH 240. Kinematics of fluid flow, properties of incompressible fluids, complex variable methods of analysis, wave motions.

PHYS 463 Introduction to Plasma Physics (3)
Prerequisite: PHYS 301; or [PHYS 410 and PHYS 411]; or [ENES 221 and ENEE 380]. Students without the electricity and magnetism prerequisite, but having a familiarity with Maxwell's equations, should check with the instructor. Orbit theory, magneto-hydrodynamics, plasma heating and stability, waves and transport processes.

PHYS 465 Modern Optics (3)
Prerequisite: PHYS 410; and PHYS 411; and PHYS 420 or PHYS 421. Designed for students with a background in fundamental optics. Topics in modern optics such as coherence, holography, principles of laser action, electron optics, and non-linear optics.

PHYS 471 Introduction to Atmospheric and Space Physics (3)
Prerequisite: PHYS 301; or [PHYS 410 and PHYS 411]; and [PHYS 420 or PHYS 421]. Motions of charged particles in magnetic fields, aspects of plasma physics related to cosmic rays and radiation belts, atomic phenomena in the atmosphere, thermodynamics and dynamics of the atmosphere.

PHYS 483 Biophysics and Theoretical Biology (3)
Designed for advanced and mature students who may have only minimal knowledge of biological processes but are well grounded in physics. Areas in bioscience where physics, biophysical chemistry, and mathematical analysis fuse to provide definition for biologic statics and dynamics.

PHYS 485 Electronic Circuits (4)
Two hours of lecture and four hours of laboratory per week. *Prerequisite: PHYS 395. Corequisite: PHYS 301 or PHYS 411.* Theory and application to experimental physics of modern semiconductor analog and digital circuits. Emphasis on understanding passive and active elements in practical circuits. Topics span the range from simple transistor circuits to microcomputers.

PHYS 487 Particle Accelerators, Physical and Engineering Principles (3)
Prerequisites: PHYS 410; and PHYS 411; and PHYS 420 or PHYS 421. Also offered as ENEE 487. Sources of charged particles; methods of acceleration and focusing of electron and ion beams in electromagnetic fields; basic theory, design, and engineering principles of particle accelerators.

PHYS 490 History of Modern Physics (3)
Prerequisite: PHYS 420 or PHYS 421 or equivalent. Primarily for senior physics majors and first year graduate students. A survey of major discoveries and trends in 20th century physics, including the relations of physics to other sciences, philosophy of science, technology and society.

PHYS 499 Special Problems in Physics (1-16)
For PHYS majors only. Research or special study. Credit according to work done.

PHYS 501 Physical Science for Elementary/Middle School Teachers I (4)
An introductory experimentally-based physical science course modeled on the program PSNS/ An Approach to Physical Science. Major concepts of chemistry and physics developed in an integrated, systematic fashion with reliance on direct laboratory observations and inferences.

PHYS 502 Physical Science for Elementary/Middle School Teachers II (4)
Prerequisite: PHYS 501. The exploration of major physics topics including mechanics, sound, light, electricity and magnetism, and modern physics.

PHYS 521 General Physics for Science Teachers I (4)
The first semester of a two-semester sequence in physics stressing physical insight for prospective secondary school science and mathematics teachers. Designed to integrate carefully lecture and laboratory and to serve as a model for persons planning to teach physics or physical science. Mathematics use will include algebra, trigonometry, with occasional references to calculus.

PHYS 522 General Physics for Science Teachers II (4)
Prerequisite: PHYS 521. A continuation of PHYS 521.

PHYS 601 Theoretical Dynamics (3)
Prerequisite: PHYS 410 or equivalent. Lagrangian and Hamiltonian mechanics, two-body central force problem, rigid body motion, small oscillations, continuous systems.

PHYS 602 Statistical Physics (3)
Prerequisite: PHYS 410 or equivalent. Credit will be granted for only one of the following: PHYS 602 or PHYS 603. Statistical mechanics, thermodynamics, kinetic theory.

PHYS 603 Methods of Statistical Physics (3)
Prerequisite: PHYS 414 or equivalent. Credit will be granted for only one of the following: PHYS 602 or PHYS 603. Foundations and applications of thermodynamics and statistical mechanics.

PHYS 604 Methods of Mathematical Physics (3)
Prerequisites: [advanced calculus; and PHYS 410; and PHYS 411]; or equivalent. Ordinary and partial differential equations of physics, boundary value problems, Fourier series, Green's functions, complex variables and contour integration.

PHYS 606 Electrodynamics (4)
Prerequisite: PHYS 604 or equivalent. Classical electromagnetic theory, electro- and magnetostatics, Maxwell equations, waves and radiation, special relativity.

PHYS 607 Advanced Classical Physics (3)
Prerequisite: PHYS 606. Selected topics in advanced classical physics will be studied from among the fields of radiation theory, spin-carrying waves, solitons and general non-linear dynamics.

PHYS 621 Graduate Laboratory (3)
Six hours of laboratory per week. Design and performance of advanced experiments in modern and classical physics.

PHYS 622 Introduction to Quantum Mechanics I (4)
Prerequisite: an outstanding undergraduate background in physics. First and second semesters. A study of the Schroedinger equation, matrix formulations of quantum mechanics, approximation methods, scattering theory, etc. Applications to solid state, atomic, and nuclear physics.

PHYS 623 Introduction to Quantum Mechanics II (3)
Prerequisite: an outstanding undergraduate background in physics. First and second semesters. A study of the Schroedinger equation, matrix formulations of quantum mechanics, approximation methods, scattering theory etc., And applications to solid state, atomic, and nuclear physics. Continuation of PHYS 622.

PHYS 624 Advanced Quantum Mechanics (3)
Prerequisite: PHYS 623. Relativistic wave equations, second quantization in many body problems and relativistic wave equations, Feynman-Dyson perturbation theory, applications to many body problems, application to quantum electrodynamics, elements of renormalization.

PHYS 625 Non-relativistic Quantum Mechanics (3)
Prerequisite: PHYS 623. Non-relativistic second quantization, single particle Green's function, perturbation theory, linked cluster expansion, Feynman and Goldstone diagrams; applications to imperfect Fermi gases; superconductivity.

PHYS 686 Charged Particle Dynamics, Electron and Ion Beams (3)
Prerequisites: [PHYS 410 and PHYS 411]; or permission of department. Also offered as ENEE 686. General principles of single-particle dynamics; analytical and practical methods of mapping electric and magnetic fields; equations of motion and special solutions; Liouville's theorem; electron optics; space charge effects in high current beams; design principles of special electron and ion beam devices.

PHYS 703 Thermodynamics (3)
Prerequisite: PHYS 602. The first and second laws of thermodynamics are examined and applied to homogeneous and non-homogeneous systems, calculations of properties of matter, the derivation of equilibrium conditions and phase transitions, the theory of irreversible processes.

PHYS 704 Statistical Mechanics (3)
Prerequisites: PHYS 411; and PHYS 602. A study of the determination of behavior of matter from microscopic models. Microcanonical, canonical, and grand canonical models. Applications of solid state physics and the study of gases.

PHYS 708 Seminar in Teaching College Physics (1)

PHYS 709 Seminar in General Physics (1)

PHYS 711 Symmetry Problems in Physics (3)
Prerequisite: PHYS 623. A study of general methods of classification of physical systems by their symmetries and invariance properties, especially in quantum field theory applications.

PHYS 718 Seminar in General Physics (1)

PHYS 719 Seminar in General Physics (1)

PHYS 721 Theory of Atomic Spectra (3)
Prerequisite: PHYS 622. A study of atomic spectra and structure: one and two electron spectra, fine and hyper-fine structure, line strengths, line widths, etc.

PHYS 722 Theory of Molecular Spectra (3)
Prerequisite: PHYS 721. The structure and properties of molecules as revealed by rotational, vibrational, and electronic spectra.

PHYS 723 Molecular Physics I (2)
Prerequisite: PHYS 623. The fundamentals of the interpretation of the spectra of simple molecules with particular attention to quantitative considerations. Emphasis on topics generally regarded as falling outside the domain of molecular structure, notably the measurement and analysis of molecular spectroscopic line intensities.

PHYS 724 Molecular Physics II (2)
Two hours of lecture per week. *Prerequisite: PHYS 623.* The fundamentals of the interpretation of the spectra of simple molecules with particular attention to quantitative considerations. Emphasis on topics generally regarded as falling outside the domain of molecular structure, notably the measurement and analysis of molecular spectroscopic line intensities. Continuation of PHYS 723.

PHYS 728 Seminar in Atomic and Molecular Physics (1)

PHYS 731 Solid State Physics: Survey (3)
A variety of topics such as crystal structure, mechanical, thermal, electrical, and magnetic properties of solids, band structure, the Fermi surface, and superconductivity will be treated. Although the emphasis will be on the phenomena, the methods of quantum mechanics are freely employed in this description.

PHYS 738 Seminar in Experimental Solid State Physics (1)

PHYS 739 Seminar in Theoretical Solid State Physics (1)

PHYS 741 Nuclear Physics: Survey (3)
Prerequisites: PHYS 622; and PHYS 623. An introductory survey of nuclear physics, including the following topics: properties of the two-nucleon force and the most popular phenomenological

potentials; properties of nuclei including radii, shapes and charge distributions; introduction to nuclear structure models, including collective, independent particle, and shell model; basic features of radioactivity including weak interactions and alpha decay; introduction to nuclear reactions, including phenomenological optical potentials and distorted wave approximations.

PHYS 748 Seminar in Experimental Nuclear Physics (1)

PHYS 749 Seminar in Theoretical Nuclear Physics (1)

PHYS 751 Elementary Particle Physics I: Survey (3)
Corequisite: PHYS 624. Nuclear forces are studied by examining interactions at high energies. Meson physics, scattering processes, and detailed analysis of high energy experiments.

PHYS 752 Elementary Particle Physics II: Theory (3)
Prerequisites: [PHYS 624; and PHYS 751]. Survey of elementary particles and their properties, quantum field theory, meson theory, weak interactions, possible extensions of elementary particle theory.

PHYS 758 Seminar in Elementary Particles and Quantum Field Theory (1)

PHYS 759 Seminar in Elementary Particles and Quantum Field Theory (1)

PHYS 761 Plasma Physics I: Survey (3)
Prerequisites: [PHYS 604; and PHYS 606]. A detailed study of plasma physics. The first semester treats particle orbit theory, magnetohydrodynamics, plasma waves, and transport phenomena.

PHYS 762 Plasma Physics II (3)
Continuation of PHYS 761. Vlasov theory, including waves, stability, and weak turbulence, kinetic equation theories of correlations and radiative processes.

PHYS 769 Seminar in Plasma Physics (1)

PHYS 771 Cosmic Ray Physics: Survey (3)
Pre- or corequisite: PHYS 601. Interaction of cosmic rays with matter, geomagnetic cutoffs, origin and propagation of cosmic rays, the electron component and its relationship to cosmic radio noise; experimental methods.

PHYS 778 Seminar in Space and Cosmic Ray Physics (1)

PHYS 779 Seminar in General Relativity (1)

PHYS 798 Special Problems in Advanced Physics (1-3)
Projects or special study in advanced physics.

PHYS 799 Master's Thesis Research (1-6)

PHYS 808 Special Topics in General Physics (1-4)
Credit according to work done.

PHYS 809 Special Topics in General Physics (1-4)
Credit according to work done.

PHYS 818 Special Topics in General Physics (1-4)
Credit according to work done.

PHYS 819 Special Topics in General Physics (1-4)
Credit according to work done.

PHYS 828 Special Topics in Atomic and Molecular Physics (1-4) Credit according to work done.

PHYS 829 Special Topics in Quantum Mechanics and Quantum Electronics (1-4)
Credit according to work done.

PHYS 832 Theory of Solids I (3)
Prerequisite: PHYS 623. Corequisite: PHYS 625. Advanced topics in the quantum theory of solids from such fields as band structure calculations, optical properties, phonons, neutron scattering, the dynamics of electrons in one-band theory, the Landau Fermi Liquid Theory, charged

Fermi liquids, the Fermi surface (surface impedance, cyclotron resonance, the DeHaas-Van Alphen Effect, etc.).

PHYS 833 Theory of Solids II (3)
Continuation of PHYS 832. Covers special topics such as magnetism, superconductivity and electron-phonon interactions.

PHYS 838 Special Topics in Experimental Solid State Physics (1-4)
Credit according to work done.

PHYS 839 Special Topics in Theoretical Solid State Physics (1-4)
Credit according to work done.

PHYS 842 Advanced Nuclear Physics: Theory I (3)
Pre- or corequisites: PHYS 624; and PHYS 625. The theory of the nucleon-nucleon force and nuclear bound states. Discussion of Brueckner theory of nuclear matter and finite nuclei and various models of nuclear structure: the Shell model, the Nilsson model, and the liquid drop model. The theory of fission and isometric states. Dynamical symmetries of nuclear excited states and the interacting boson approximation.

PHYS 843 Advanced Nuclear Physics: Theory II (3)
Prerequisite: PHYS 842. The theory of the nucleon-nucleon force and nuclear reactions. Discussion of such topics as: the theory of the optical potential, high-energy scattering of nucleons and Glauber theory, interaction of nuclei with mesons and hyperons, photonuclear reactions, scattering and reactions of nuclear heavy ions, Lepton-nucleus scattering, and few nucleon scattering and Faddeev theory.

PHYS 849 Special Topics in Theoretical Nuclear Physics (1-4)
Credit according to work done.

PHYS 851 Advanced Quantum Field Theory (3)
Prerequisite: PHYS 624. Renormalizations of Lagrangian field theories, Lamb shift, positronium fine structure, T. C. P. Invariance, connection between spin and statistics, broken symmetries in many body problems, soluble models, analyticity in perturbation theory, simple applications of dispersion relations.

PHYS 852 Theoretical Methods in Elementary Particles (3)
Pre- or corequisite: PHYS 851.

PHYS 853 Quantum Field Theory (3)
Corequisite: PHYS 851. Introduction to Hilbert space, general postulates of relativistic quantum field theory, asymptotic conditions, examples of local field theory, Jost-Lehmann-Dyson representation and applications, generalized free field theory, general results of local field theory-tcp theorem, spin statistics connections, Borcher's theorems, Reeh-Schlieder theorem.

PHYS 858 Special Topics in Elementary Particles and Quantum Field Theory (1-4)
Prerequisites: PHYS 851 and PHYS 752. First semester.

PHYS 859 Special Topics in Elementary Particles and Quantum Field Theory (1-4)
Credit according to work done.

PHYS 862 Controlled Fusion Physics and Technology (3)
Prerequisite: PHYS 761. Review of fusion plasma physics, followed by high voltage pulse technology, ion sources, high power lasers; magnetic and inertial confinement schemes, major "matches" in controlled thermonuclear research.

PHYS 863 Plasma Equilibrium, Stability and Transport Properties (3)
Prerequisite: PHYS 762 or equivalent. Applications of magnetohydrodynamics and kinetic theory to the equilibrium, stability and transport properties of magnetically confined high temperature plasmas.

PHYS 864 Nonlinear Effects and Radiation Processes in High-temperature Plasmas (3)
Prerequisite: PHYS 762. Advanced survey of fundamental nonlinear effects and radiation processes in high-temperature plasmas.

PHYS 869 Special Topics in Plasma Physics (1-4)
Credit according to work done.

PHYS 875 Theory of Relativity: Survey (3)
Prerequisite: PHYS 601. A brief survey of Einstein's special theory of relativity followed by a solid introduction to general relativity and its applications.

PHYS 878 Special Topics in Space and Cosmic Ray Physics (1-4) Credit according to work done.

PHYS 879 Special Topics in General Relativity (1-4)
Credit according to work done.

PHYS 888 Special Topics in Applied Physics (2)

PHYS 889 Special Topics in Interdisciplinary Problems (1-4)
Prerequisite: permission of instructor. Credit according to work done.

PHYS 899 Doctoral Dissertation Research (1-8)

PORT – Portuguese

PORT 478 Themes and Movements of Luso-Brazilian Literature in Translation (3)
Repeatable to 6 credits if content differs. A study of specific themes and movements either in Portuguese or Brazilian literature, as announced. Designed for students for whom the literatures would be inaccessible in Portuguese.

PORT 699 Independent Study of Portuguese (1-3)
Repeatable to 3 credits. This course is designed to provide graduate students an opportunity to pursue independent study under the supervision of a member of the department.

PSYC – Psychology

Some of these courses may require the use of animals. See the statement on Animal Care and Use in the appendix and the policy statement for students under degree requirements.

PSYC 400 Experimental Psychology: Learning and Motivation (4)
Two hours of lecture and four hours of laboratory per week. *Prerequisites: PSYC 200; completion of the departmentally required English, math and science supporting course sequence; and permission of department.* The experimental analysis of behavior, with emphasis on conditioning, learning and motivational processes. Experiments on the behavior of animals.

PSYC 401 Advanced Laboratory in the Experimental Analysis of Behavior (3)
Prerequisite: PSYC 400. An intensified extension of the principles and techniques demonstrated in the laboratory of PSYC 400. Emphasis on complex schedules of reinforcement, and experimental designs using repeated measures.

PSYC 402 Physiological Psychology (3)
Prerequisite: PSYC 206 or PSYC 301. Credit will be granted for only one of the following: ZOOL 323 or PSYC 402. An introduction to research on the physiological basis of human behavior, including considerations of sensory phenomena, motor coordination, emotion, drives, and the neurological basis of learning.

PSYC 403 Animal Behavior (3)
Prerequisite: PSYC 206 or PYSC 301. A study of animal behavior, including considerations of social interactions, learning, sensory processes, motivation, and experimental methods, with a major emphasis on mammals.

PSYC 404 Introduction to Behavioral Pharmacology (3)
Prerequisite: PSYC 206; or PSYC 301; or PSYC 400; or a course in zoology. The basic findings and theoretical viewpoints on the interaction of drugs and behavior. Introduction to basic prin-

ciples of pharmacology, the effects of drugs on various behavior, experimental analysis of drug dependence and abuse, and neuropharmacology and behavior.

PSYC 405 Applied Behavior Analysis (3)
Prerequisite: PSYC 301. Theoretical and research literature in the application of operant and respondent conditioning principles to human behavior. Approaches to behavior problems in school, home and professional settings.

PSYC 410 Experimental Psychology: Sensory Processes I (4)
Three hours of lecture and two hours of laboratory per week. *Prerequisites: PSYC 200; and completion of the English, math and science supporting course sequence; and permission of department. A student who has completed PSYC 310 must have permission of the instructor in order to register for PSYC 410.* A systematic survey of the content, models, and methodology of sensory and perceptual research.

PSYC 415 History of Psychology (3)
Prerequisite: twelve credits in psychology or permission of department. The origins of psychology in philosophy and biology, and the development of psychology as a science in the nineteenth and twentieth centuries. Consideration of current theoretical perspectives and experiments in relation to the enduring problems of psychology, and of the role of culture, science, and technology in the development of psychological ideas.

PSYC 420 Experimental Psychology: Social Processes I (4)
Two hours of lecture and four hours of laboratory per week. *Prerequisite: PSYC 200; and PSYC 221; and completion of the departmentally required English, math, and science supporting course sequence; and permission of department.* A laboratory course to provide a basic understanding of experimental method in social psychology and experience in conducting research on social processes.

PSYC 421 Experimental Psychology: Social Processes II (4)
Prerequisite: PSYC 420. Two hours of lecture and four hours of laboratory per week. An advanced laboratory course providing intensive training in experimental work in social psychology and the opportunity to design and carry out original research on social processes.

PSYC 423 Advanced Social Psychology (3)
Prerequisite: PSYC 420, or permission of department. A systematic review of research and points of view in regard to major problems in the field of social psychology.

PSYC 424 Communication and Persuasion (3)
Prerequisite: PSYC 221 or equivalent. The effect of social communication upon behavior and attitudes. Theory and research concerning attitude change and social influence.

PSYC 432 Introduction to Counseling Psychology (3)
Prerequisite: nine hours in psychology. A survey and critical analysis of research and intervention strategies developed and used by counseling psychologists. Examination of both historical and current trends in content and methodology.

PSYC 433 Analysis of Helping Relationships (3)
Two hours of lecture and two hours of laboratory per week. *Prerequisites: PSYC 200; [and PSYC 235 or PSYC 334 or PSYC 435 or PSYC 432].* Theories and research strategies regarding effective helping relationships. Basic components of helping relationships and how to conduct a research project evaluating helping behavior and its impact on others.

PSYC 435 Personality Theories (3)
Prerequisite: PSYC 100; and PSYC 200 or equivalent. Major theories of personality and research methods and findings relevant to those theories.

PSYC 436 Introduction to Clinical Psychology (3)
Prerequisite: PSYC 100. A survey and critical analysis of clinical psychology, with particular emphasis on current developments and trends.

PSYC 440 Experimental Psychology: Cognitive Processes (4)
Three hours of lecture and two hours of laboratory per week. *Prerequisites: PSYC 100; and PSYC 200 or a statistics course from an approved departmental list; and completion of the departmentally required English, math and science supporting course sequence; and permission of department.* A survey of the content, models, and methods in cognitive psychology with an emphasis on auditory and visual pattern recognition, information processing, attention, memory, learning, problem solving, and language.

PSYC 442 Psychology of Language (3)
Prerequisite: PSYC 200; and PSYC 341 or PSYC 440, or permission of department. Introductory survey of topics in psycholinguistic research, theory and methodology. Major emphasis on the contribution of linguistic theory to the psychological study of language behavior and cognition. Linguistic theory, biological bases of language, and speech, grammars, phonetics and phonological performance, speech perception and production, psychological studies of syntax and semantics, language and cognitive development, language comprehension and thought.

PSYC 443 Thinking and Problem Solving (3)
Prerequisites: PSYC 200; and [PSYC 341 or PSYC 440] or permission of department. Historical development, current theory and data, and research methods in problem solving. Formal problem solving theory and computer models of thinking and human problem-solving behavior. The uses of strategies to improve students' own thinking processes and problem-solving behavior.

PSYC 444 Cognitive Structure in Perception (3)
Prerequisite: PSYC 200; and [PSYC 341 or PSYC 440] or permission of department. Perception as an information extraction and pattern recognition process. Complex form and space perception and pattern recognition of speech. Review of early studies of form and pattern perception which support information processing state or cascade models of perceptual capacities; studies on development and the roles of learning and attention.

PSYC 451 Principles of Psychological Testing (4)
Three hours of lecture and two hours of laboratory per week. *Prerequisite: PSYC 200.* A survey of the basic concepts and theories of psychological measurement illustrated through demonstration of principal approaches to psychological testing.

PSYC 452 Psychology of Individual Differences (3)
Prerequisite: PSYC 200. Problems, theories and research related to psychological differences among individuals and groups.

PSYC 453 Mathematical Psychology (3)
Prerequisite: PSYC 200 or equivalent; and permission of department. A survey of mathematical formulations in psychology, including measurement and scaling models, statistical and psychometric models, and elementary mathematical representations of psychological processes in learning, choice, psychophysics, and social behavior.

PSYC 455 Life-Span Cognitive Development (3)
Prerequisite: PSYC 355 or PSYC 341 or PSYC 440 or equivalent. Theory and research in cognition from a life-span developmental perspective. Topics include memory, reasoning, attention, spatial, cognition and conceptual organization and discussions of implications of current research for a variety of educational interventions.

PSYC 456 Research Methods in Developmental Psychology (3)
Prerequisites: PSYC 200 and [PSYC 355 or PSYC 356 or PSYC 357]. A presentation of major research designs used in developmental psychology and of the methodology used in developmental research, such as observational research, program evaluation and laboratory experimentation.

PSYC 457 Cultural Context of Psychological Development (3)
Prerequisite: [PSYC 355, or PSYC 356, or PSYC 357,] or permission of department. An examination of whether important differences or similarities exist among and within cultures in the way people develop psychological competencies in the period from birth through adolescence.

PSYC 458 Applied Developmental Psychology (3)
Prerequisite: PSYC 200 and [PSYC 355, or PSYC 356, or PSYC 357]. Repeatable to 6 credits if content differs. An examination of a topic in developmental psychology which has been examined in the laboratory and is central to developmental theories. Extension of these analyses to practical and social issues in the daily life of the developing individual. Topics will vary from semester to semester.

PSYC 460 Psychological Foundations of Personnel Selection and Training (3)
Prerequisite: PSYC 200 or equivalent. An examination of issues and processes involved in the design and evaluation of personnel selection and training programs in a variety of organizational settings: job, person and organizational analysis; organizational choice; development of predictors; evaluation of instructional and training systems; criteria for performance evaluation, promotion and training.

PSYC 462 Engineering Psychology and Training Models (3)
Prerequisite: PSYC 200 or equivalent; and PSYC 361 or permission of department. For PSYC majors only. An examination of theories and research regarding human performance capabilities and skills (information processing, decision-making, environmental constraints, automation), training procedures (traditional methods, programmed learning, computer-assisted instruction) and models and procedures for evaluating training programs in industry, education, and service organizations.

PSYC 463 Psychology of Motivation and Attitudes in Organizational Settings (3)
Prerequisite: PSYC 361 or equivalent. Theories, research and practice regarding the assessment, understanding, and prediction of motivation at work. Theories of, and the assessment and consequences of, various work-related attitudes. An integration of theory, research and practice.

PSYC 464 Psychology of Leaders in Work Organizations (3)
Prerequisite: PSYC 361 or equivalent. The psychologial assumptions and implications of various theories of management and leadership. Selections and training; development of careers; influence processes; change of managerial behavioråd the impact of the larger environment, nature of product or service, and organization structure on managerial behavior.

PSYC 465 Psychology of Organizational Processes (3)
Prerequisite: PSYC 361 or equivalent. Various theories of interpersonal, intra- and inter-group relations, with emphasis on issues of conflict, competition, cooperation and the role of power in organizations. Organizational diagnosis and intervention.

PSYC 466 Environmental and Ecological Psychology (3)
Prerequisite: PSYC 200 or equivalent. An examination of measurement, description, and impact of the physical and social environments that affect various aspects of behavior in school, at work, and during leisure.

PSYC 468 Field Experience and Special Assignments in Honors (1-3)
Prerequisite: permission of department as well as supervisor and honors faculty. Repeatable to 6 credits. An individual experience arranged by the honors student and his or her supervisor. A proposal submitted to the honors faculty in the semester preceding registration for the course should state the activities anticipated and the method of evaluation.

PSYC 469 Honors Thesis Proposal Preparation (1-3)
Prerequisite: Honors thesis supervisor's approval. Repeatable to 3 credits. Development of honors thesis proposal by preliminary research and literature review. Presentation of formal proposal to the thesis committee.

PSYC 478 Independent Study in Psychology (1-3)
Prerequisite: permission of both department and instructor in the form of a written agreement signed by the student and the faculty mentor. The student must have completed 9 hours in psychology with at least a 3.0 G.P.A. in psychology and a 2.8 overall G.P.A. Students may not accumulate more than a total of 9 credits in PSYC 478 and PSYC 479 without permission of the Chair of the Department of Psychology or the Psyschology Undergraduate Committee. Integrated reading under direction leading to the preparation of an adequately documented report on a special topic.

PSYC 479 Special Research Problems in Psychology (1-3)
Prerequisite: permission of both department and instructor in the form of a written agreement signed by the student and the faculty mentor. The student must have completed 9 hours in psychology with at least a 3.0 G.P.A. in psychology and a 2.8 overall G.P.A. Repeatable to a maximum or 9 credits unless there is a waiver from the Psychology Undergraduate Committee. Research and data collection under individual faculty supervision, leading to a written research report.

PSYC 488 Advanced Psychology I (Honors) (3)
Prerequisite: PSYC 200 and permission of department. Seminar covering topics in sensation, perception, learning, and motivation.

PSYC 489 Senior Seminar (3)
Prerequisite: PSYC 100. Treatment of a specialized topic in psychology.

PSYC 498 Advanced Psychology II (Honors) (3)
Prerequisite: PSYC 488H or permission of department. Semester covering topics in measurement, social processes, developmental processes and other subject matter of current interest.

PSYC 499 Honors Thesis Research (3)
Prerequisite: PSYC 469 and permission of thesis advisor.

PSYC 601 Quantitative Methods I (3)
Prerequisite: PSYC 200 or equivalent. A basic course in mathematical formulations and quantitative analysis in psychology, with an emphasis on measurement, probability, statistical inference and estimation, regression, and correlation.

PSYC 602 Quantitative Methods II (3)
Prerequisite: PSYC 200 and PSYC 601 or equivalent. A basic course in mathematical formulations and quantitative analysis in psychology, with an emphasis on measurement, probability, statistical inference and estimation, regression, and correlation.

PSYC 611 Advanced Developmental Psychology (3)
Empirical, experimental and theoretical literature related to developmental processes.

PSYC 612 Theories of Personality (3)
Scientific requirements for a personality theory. Postulates and relevant research literature for several current personality theories.

PSYC 619 Clinical Research Team (1-3)
Repeatable to 6 credits. Discussion of research topics; presentation and critique of original research proposals in clinical psychology.

PSYC 640 Fundamentals of Social Psychology (3)
Method, research and theory in social psychology.

PSYC 651 Sensory and Perceptual Processes (3)
A broad coverage of knowledge in sensory and perceptual processes. Major theories and antecedents of contemporary research in the field.

PSYC 660 Human Biopsychology (3)
An introductory graduate level course in human psychobiology designed for graduate students with little specific training in this area. Introduction to the comparative and evolutionary approach

to the study of human behavior, the biobehavioral basis of human sexuality and social behavior, the physiological basis of higher cortical functions in humans including language, memory, and spatial perception, and an introduction to neuropharmacology.

PSYC 661 Experimental Analysis of Behavior (3)
Fundamental principles, theoretical framework and areas of application of the experimental analysis of behavior.

PSYC 671 Advanced Topics in Human Learning and Cognitive Psychology (3)
A systematic review of major topic areas in the general field of human learning and cognition with particular emphasis upon information processing, memory, and linquistic processes.

PSYC 678 Seminar in Psycholinguistics (3)
Prerequisite: PSYC 671. Repeatable to 6 credits. Contemporary psycholinguistic theories of language acquisition and use. Phonological, semantic and syntactic aspects of language.

PSYC 679 Seminar in Cognitive Development (3)
Prerequisite: PSYC 611 or PSYC 671. Repeatable to 6 credits. Advanced coverage of research methodology and research issues in various areas of cognitive development such as categorization, spatial understanding, language acquisition, and memory. Emphasis on interrelationships among developmental changes across the life-span. Utility of a developmental perspective in analyzing the components of cognition.

PSYC 688 Historical Viewpoints and Current Theories in Psychology (3)

PSYC 701 Multivariate Analysis I (3)
Prerequisite: PSYC 602 or permission of department. Fundamentals of maxtrix algebra, multivariate distributions, multivariate estimation problems and test of hypotheses, general linear model.

PSYC 702 Multivariate Analysis II (3)
Prerequisite: PSYC 701 or permission of department. Component and factor analysis with emphasis on the appropriateness of the models to psychological data. Both theoretical issues and research implications will be discussed. The course will treat the factor analytic model, the three indeterminant problems of communalities, factor loadings, and factor scores, extraction algorithms, rotational algorithms, and the principal component model.

PSYC 703 Scaling Techniques and Theory (3)
Prerequisite: PSYC 602 or permission of department. Theory of measurement as applied to psychology; and the associated experimental techniques needed to construct measurement scales. The principal psychophysical and psychometric scaling models are discussed.

PSYC 704 Test Theory (3)
Prerequisite: PSYC 602 or permission of department. A survey of theories of test construction with emphasis on reliability, validity, and criteria problems. Topics covered include item analysis, reliability, validity, research on culture-free tests, generalizabillty theory, and item-response theory. Students will learn how to develop content valid tests and they will critique content valid tests based upon professional standards.

PSYC 705 Mathematical Models of Memory and Cognition (3)
Prerequisite: PSYC 602 or permission of department. Topics to be covered include a review of basic probability theory; models of learning, memory and attention; stimulus sampling theory; computer simulations of cognitive processes.

PSYC 706 Seminar in Prediction (3)
Prerequisite: PSYC 602 or permission of department. In depth review of techniques for prediction in the behavioral sciences. Emphasis on both theoretical rationale and research implications.

PSYC 707 Theory of Decision and Choice (3)
Prerequisite: PSYC 602 and permission of department. A study of algebraic and probabilistic models for decision and choice behavior, and related experimental procedures. Topics include:

measurement of preference, subjective utility models for certain and uncertain outcomes, normative strategies, decision making styles, and group decision making.

PSYC 708 Seminar in Psychometric Theory (3)
Prerequisite: PSYSC 602 or permission of department. Repeatable to 9 credits if content differs. Study of the current practices, trends, or recent developments in psychometric theory.

PSYC 709 Seminar in Mathematical Models (3)
Prerequisite: PSYC 602 or permission of department. Repeatable to 9 credits if content differs. Special topics in mathematical psychology. A discussion of quantitative representations of psychological processes in one or more substantive areas of psychology.

PSYC 711 Introduction to Counseling Psychology (3)
Prerequisite: permission of department. Introduction to the professional field, examination of pertinent scientific and philosophical backgrounds, and survey of the major theories, principles, and training models in counseling. Correlated laboratory analogue experiences in dyadic and group interrelationships.

PSYC 712 Principles and Procedures of Counselor Functions (3)
Prerequisite: PSYC 711. Specific functions and areas of specialization of the counseling psychologist including vocational psychology, use of tests in counseling, and student ecology. Principles of consultation, interprofessional relations, and ethical standards. Concurrent correlated laboratory experiences for all topics.

PSYC 713 Fundamentals of Clinical/Community Psychology (3)
Prerequisite: permission of department. Analysis of clinical/community psychology as a scientist professional paradigm, its cultural and historical roots and its scientific and professional evolution; selected coverage of current major research topics, e.g., psychotherapy, psychopathology, community; current nature of clinical psychology and evolving trends.

PSYC 718 Research Issues in Clinical, Counseling, and Community Psychology (3)
Prerequisite: permission of department. Repeatable to 9 credits if content differs. Issues and strategies in conceptual systems, designs and methodologies of current research in these areas; critical analysis of current research.

PSYC 719 Seminar in Clinical, Counseling, and Community Psychology (3)
Prerequisite: permission of department. Repeatable to 9 credits if content differs. Advanced selected topics in areas such as psychotherapy, consultation, assessment, psychopathology, student ecology, etc.

PSYC 721 Assessment Issues in Clinical/Community Psychology I (2)
Prerequisite: permission of department. Corequisite: PSYC 722. PSYC 721 and PSYC 722 must be taken concurrently due to the integration of individual and ecological perspectives. Introduction to a broad range of approaches, theories, and research focusing primarily on intellectual assessment of the person and evaluating the larger social context of the assessment enterprise (Family and Treatment settings). Other assessment approaches include observation and interviewing and the use of rating proceduares and standardized tests.

PSYC 722 Assessment Issues in Clinical/Community Psychology I (2)
Prerequisite: permission of department. Corequisite: PSYC 721. PSYC 721 and PSYC 722 must be taken concurrently due to the integration of individual and ecological perspectives. Introduction to a broad range of approaches, theories, and research focusing primarily on intellectual assessment of the person and evaluating the larger social context of the assessment enterprise (Family and Treatment settings). Other assessment approaches include observation and interviewing and the use of rating procedures and standardized tests.

PSYC 723 Assessment Issues in Clinical/Community Psychology II (2)
Prerequisite: permission of department. PSYC 723 and 724 must be taken concurrently due to the integration of individual and ecological perspectives. Introduction to a broad range of ap-

proaches, theories, and research focusing primarily on assessing the person with personality questionnaires and projective techniques and evaluating the larger context in which the person resides (work, school, and community settings). Other assessment apporaches include observation and interviewing, and rating procedures, and standardized tests.

PSYC 724 Assessment Issues in Clinical/Community Psychology II (2)
Prerequisite: permission of department. PSYC 723 and 724 must be taken concurrently due to the integration of individual and ecological perspectives. Introduction to a broad range of approaches, theories, and research focusing primarily on assessing the person with personality questionnaires and projective techniques and evaluating the larger context in which the person resides (work, school, and community settings). Other assessment approaches include observation and interviewing, and rating procedures, and standardized tests.

PSYC 727 Introductory Counseling Practicum (3)
Prerequisite: PSYC 711; and PSYC 712. Supervised training in application of methods relevant to behavior change through counseling.

PSYC 728 Introductory Didactic-Practicum in Psychological Intervention (3)
Prerequisite: permission of department. Repeatable to 9 credits. Introduction to concepts and skills of psychological intervention emphasizing the relationship to the behavioral science foundation theories, methods and research findings with the development and utilization of intervention skills. The course includes supervised experience in intervention skills as designated by the subtopics of the course.

PSYC 729 Advanced Didactic-Practicum in Psychological Intervention (3)
Prerequisite: permission of department and [PSYC 727 or PSYC 728]. Repeatable to 9 credits. Concept, research and supervised experience in intervention skills in advanced specialized areas, e.g., college student counseling, child evaluation, parent and school consultation, psychoevaluation, behavioral therapy, individual psychotherapy.

PSYC 730 Introduction to Industrial and Organizational Psychology (3)
Advanced survey of industrial-organizational psychology, including selection, training, motivation, group processes, leadership, organizational psychology, and organizational theory. Readings stressed and seminar time will be used for lectures, discussion and integration of the reading materials.

PSYC 731 Training Procedures and Evaluation in Organizational Settings (3)
Prerequisite: PSYC 730. Focus on needs assessment and program evaluation issues concerning training interventions in work organizations. Topics covered include organizational analyis, job analysis, criterion development and evaluation methodology, as well as instructional techniques such as behavioral role modeling and rater training. Also, social issues concerning training interventions such as fair employment practices, hard core unemployed workers, and training implications for aging workers are discussed.

PSYC 732 Selection and Classification Issues in Organizations (3)
Prerequisite: PSYC 730, and PSYC 601 and PSYC 602 or equivalent, or permission of department. Consideration of societal, organizational and individual demands for appropriate use of individual differences in (primarily) initial placement of employees. Recruitment, and selection issues, the role of governmental regulations, and the role of individual factors in individual behavior are considered. Extensive coverage given to fundamental psycho-metric problems and the development of individual and organizational criteria of effectiveness.

PSYC 733 Organizational Psychology (3)
Prerequisite: PSYC 730, PSYC 601; and PSYC 602, or equivalent, or permission of department. Emphasizes theories and data regarding the impact of environmental factors on individual, group, and organizational behavior. Group dynamics, leadership, and power, motivation and satisfaction, and organization structure and environment are examined as correlates of behavior.

PSYC 734 Motivation and Attitudes in Organizations (3)
Prerequisite: PSYC 730 and permission of department. Major theories of human motivation in organizational contexts. Included will be theories concerning some determinants of performance, satisfaction and dissatisfaction, the relationship between satisfaction and performance, determinants of boredom and fatigue, and the functions and effects of incentives.

PSYC 735 Seminar in Human Performance Theory (3)
Prerequisite: permission of department. An examination of man-machine interaction with emphasis on the theories and research which focus on human performance capabilities and skills. Some of the topics covered are information processing and communications, human computer interaction, decision making, environmental constraints and automation.

PSYC 738 Seminar in Industrial Psychology (3)
An advanced seminar covering specialized topics such as: morale and motivation, labor relations, consumer motivations, man-machine systems, quantitative and qualitative personnel requirements inventory, job evaluation, environment conditions and safety, occupational choice and classification, and the interview.

PSYC 740 Social Psychology Research Methodology (3)
A review of research methodology in social psychology, including research design, techniques of data collection, and the interpretation of data. Emphasis is placed on developing skill in evaluating studies and generating research designs.

PSYC 741 Attitude Change (3)
A review of research and theory concerning the nature of attitudes and the determinants of attitude change.

PSYC 742 Group Behavior (3)
A review of research and theory concerning a) intra-group behavior, including topics such as problem solving, communication, leadership and conformity; and b) inter-group behavior, including the processes of social stereotyping and prejudice.

PSYC 743 Person Perception (3)
A review of research and theory concerning the attribution of personal characteristics, errors and biases in social judgement, social information processing and person memory.

PSYC 748 Seminar in Social Psychology (3)
Repeatable to 15 credits if content differs. A seminar on selected topics in social psychology.

PSYC 749 Current Research in Social Psychology (1-3)
Repeatable to 12 credits if content differs.

PSYC 751 The Cross-Cultural Context of Psychological Development (3)
Prerequisite: PSYC 611. The methodological issues in making comparisons of developmental status across different cultures and subcultures. The ways different cultural contexts affect the acquisition and employment of various cognitive skills.

PSYC 752 Developmental Transitions from Informal to Formal Knowledge (3)
Prerequisite: PSYC 611. Research and theory on the conversion of informal practical knowledge to abstract formal systems and on individual differences and socialization practices which influence the transition.

PSYC 753 The Psychology of Adult Development and Aging (3)
Prerequisite: PSYC 611. Theoretical models of stability and change during the adult years. Experimental tasks for assessing adult development and appropriate research designs. Selected topics in adult development and their implications for the design of interventions.

PSYC 758 Seminar in Vision (3)
Prerequisite: PSYC 651 or permission of department. Repeatable to 6 credits if content differs. Selected topics in vision.

PSYC 759 Seminar in Auditory Mechanisms (3)
Prerequisite: PSYC 651 or permission of department. Repeatable to 6 credits if content differs. Selected topics in auditory and psychoacoustic research, with emphasis on sensory and perceptual phenomena and their physiological bases.

PSYC 761 Advanced Laboratory Techniques (1-3)
Methodology of research techniques and apparatus; apparatus design and construction; computer control of behavioral experiments.

PSYC 762 Comparative Psychology (3)
Prerequisite: PSYC 661. The experimental literature on the behavior of non-human organisms. Special topics.

PSYC 763 Advanced Psychophysiology (3)
Alternate years.

PSYC 764 Comparative Neuroanatomy (3)
Prerequisite: permission of department. Demonstrations and lectures on the gross, microscopic and ultrastructural morphology of the central nervous system of vertebrates.

PSYC 765 Seminar in Psychopharmacology (3)
Prerequisite: One year of graduate study in psychology and permission of instructor. A critical review and detailed analysis of the literature and problems related to the effects of drugs on animal and human behavior. Designed for advanced graduate students in experimental psychology and clinical psychology.

PSYC 766 Laboratory Methods in Neuroanatomy (3)
Prerequisite: permission of department. Laboratory practice in the perfusion and fixation of neural tissue. Training in the use of the compound microscope, the microprojector, the reconstruction of brain lesions, macro- and microphotography of neural tissue and the tracing of connections in the central nervous system.

PSYC 768 Conditioning and Learning (3)
Prerequisite: PSYC 622. Alternate years. The literature on the experimental analysis of behavior, with examination of basic experiments and contemporary theories related to them.

PSYC 778 Seminar in Learning and Memory (3)
Prerequisite: PSYC 671. Repeatable to 6 credits if content differs. An advanced topical seminar covering the areas of human learning and memory. Acquisition processes, storage and retrieval processes, and attention and information processing.

PSYC 788 Special Research Problems (1-4)
Supervised research on problems selected from the areas of experimental, industrial, social, quantitative, or mental health psychology.

PSYC 789 Special Research Problems (1-4)

PSYC 798 Graduate Seminar (2)

PSYC 799 Master's Thesis Research (1-6)

PSYC 818 Research Issues in Personality Or Development (3)
Prerequisites: PSYC 601; and PSYC 602; and either PSYC 611 or PSYC 612 or equivalent, depending on course content. Repeatable to 9 credits. Experimental design and methodology and statistical treatment of data appropriate to personality or developmental research; critical analysis of major current areas of research including methodologies, findings and implications. The course will focus on either personality research or developmental research in a given semester.

PSYC 819 Seminar in Personality and Development (3)
Repeatable to 9 credits. An advanced seminar covering specialized topics.

PSYC 858 Contemporary Theories in Sensory Processes (3)
Prerequisite: PSYC 651 or permission of department. Repeatable to 6 credits. Specialized study of sensory processes with emphasis on mathematical models.

PSYC 859 Special Topics in Perception (3)
Prerequisite: PSYC 651 or permission of department. Repeatable to 6 credits. Intensive study of selected topics in perception.

PSYC 878 Current Research in Language and Cognition (3)
Prerequisite: PSYC 671. Repeatable to 6 credits. Seminar will cover current research and methodological issues in language and cognition. Specialized topics include: computer models of cognitive behavior; cross-cultural studies in language and thought; mathematical and analytical techniques for assessing structures; and others.

PSYC 888 Research Methods in Psychology (1-3)

PSYC 889 Research Methods in Psychology (1-3)

PSYC 898 Graduate Seminar (2)

PSYC 899 Doctoral Dissertation Research (1-8)

PUAF – Public Affairs

PUAF 600 Managerial Accounting (3)
Prerequisite: permission of department. Basic corporate accounting model compared with governmental/not-for-profit counterpart. Preparation, use and limitations of financial statements in private and public sectors. Introduction to cost and budgeting concepts.

PUAF 601 Professional Development Seminar (1)
Prerequisite: permission of department.

PUAF 610 Quantitative Methods in Policy Analysis (3)
Prerequisite: permission of department. An introduction to the use of statistical and mathematical analysis of public policy problems utilizing skills in statistics, probability theory, computer programming, and regression analysis. Recognition of inaccurate analyses and the use of available tools in the construction of models.

PUAF 611 Quantitative Analysis of Policy Issues (3)
Prerequisite: permission of department. Study of a series of problems and the development of quantitative techniques to describe or evaluate the problem. The organization and interpretation of complex data and its use for prediction and inference about casual effects. The definition of objectives, trade-offs among objectives, and allocation of resources to meet objectives. Sensitivity of outcomes to changing conditions.

PUAF 620 Political Analysis (3)
Prerequisite: permission of department. Examination of politics as a process for allocating scarce resources among claimants for public benefits. Comparision of the allocative model of politics with other distributive processes such as markets. Comparison of the model with behavior of different political institutions such as Congress and the presidency. Study of politics as a process with distinctive concepts of rationality. The translation of voter and interest group preferences into public choices. The impact of political decisions on competing constituencies.

PUAF 630 Government Intervention in the Private Sector (3)
Prerequisite: permission of department. The ways in which different social science disciplines analyze and evaluate public policy in a single area. Government involvement in private sector decision making. Theories of government intervention, measures of the degree of intervention; instruments of intervention and their consequence for private and social performance; and the politics, ethics, and economics of reducing the level of intervention.

PUAF 640 Microeconomic Theory and Policy Analysis (3)
Prerequisite: permission of department. The application of microeconomic theory to public policy problems. The theory of resource allocation in the firm and by the individual consumer; the response of these economic agents to changes in incentives; the properties of market allocations in competitive and non-competitive environments; the nature of market failures; and government interventions to remedy those failures.

PUAF 641 Macroeconomic Theory and Policy Analysis (3)
Prerequisite: permission of department. An introduction to competing macroeconomic theories: Keynesian, monetarist, and "supply side." In the light of these theories, evaluation of the Kant performance of the American economy and of policies designed to alter that performance. An examination of public policy issues having both microeconomic and macroeconomic components.

PUAF 650 Normative Analysis (3)
Prerequisite: permission of department. The normative or philosophical issues involved in public policy issues: the limits and usefulness of decision making tools like cost/benefit analysis; problems of choosing, justifying and using criteria to judge a program's success and/or appropriateness; and questions of personal conduct. Consideration of such policy problems as tariffs, income distribution, and reverse discrimination.

PUAF 660 Policy Workshop (3)
Prerequisite: permission of department. The development and presentation of a standard analysis of a policy problem. Substantial group work, field research, report writing, and oral presentations required. The difficulties of creating an effective and useful analysis. Development of techniques to aid in overcoming those difficulties.

PUAF 670 Finance (3)
Prerequisite: permission of department. Introduction to principles of resource allocation over time, role of debt in context of changing sources of governmental revenues, long and short-term debt instruments, analysis of mixed public-private economic development projects, leasing, impact of borrowing devices.

PUAF 698 Selected Topics in Public Affairs (1-3)
Prerequisite: permission of department. Special topics that arise in public policy.

PUAF 700 U.S. Trade: Policy and Politics (3)
Prerequisites: [PUAF 620; and PUAF 640; and PUAF 641] and permission of department. Interplay between government and private interests in shaping official actions that affect international trade. Policy tools available to influence balance, magnitude, and composition of imports and exports. Evolution of executive, congressional and quasi-judicial government institutions under increased U.S. international trade exposure and trade deficit.

PUAF 701 Public Policies Toward Business: Legal Institutions (3)
Prerequisite: permission of department. The legal constraints on the use of instruments by which governments attempt to alter business conduct and performance. The legal processes through which these instruments operate. The legal environment of business- government relations.

PUAF 702 Regulatory Analysis (3)
Prerequisite: permission of department. Economic theory and political determinants of economic and social regulation. Effects of various regulatory programs analyzed. Impacts of specific regulatory rules studied using cost-benefit analysis. Causes and effects of deregulation of selected markets.

PUAF 703 Labor Market and Regional Economic Policy (3)
Prerequisites: [PUAF 640; and PUAF 610; and PUAF 611] and permission of department. Examines business and government policy, which responds to the need to restructure basic industry and changing composition of jobs in the economy. Trends towards increased coordination of

government and business policies in workforce reduction, retaining, and economic development examined, and methods for evaluating policy effectiveness studied.

PUAF 704 Productivity and Innovation (3)
Prerequisite: permission of department. Trends in productivity and technological innovation in United States and other industrial countries. Explanations for the productivity slowdown since the 1970's. Implications of these developments for U.S. competitiveness and the role of government in promoting productivity and innovation.

PUAF 710 Public Sector Program Operations (3)
Prerequisite: permission of department. The main institutional features of three common state and local governmental functions: income maintenance (including welfare, workman's compensation, unemployment insurance, etc.), health care (including Medicaid, hospital financial operations, etc.), and economic development (including site selection, financial incentives, etc.).

PUAF 711 Management Strategies in Public Organizations (3)
Prerequisite: permission of department. The day to day problems faced by public sector managers, including setting out an organization's goals, obtaining and protecting a mandate for a new program, designing a service delivery system, implementing a new program, supervising subordinates, and marketing a new program to the public.

PUAF 712 Analysis of Fiscal Conditions (3)
Prerequisite: permission of department. The financial operations of U.S. government at various levels, with emphasis on local governments. Practical problems in revenue management, including revenue forecasting and cash flow analysis; debt management operations, such as borrowing; intergovernmental financial operations, such as grants management and reporting requirements, and personnel management issues that have a direct bearing on governmental finances.

PUAF 714 Advanced Financial Management (3)
Prerequisite: permission of department. Political and economic contexts of projects discussed and the role of analysis in the decision-making process.

PUAF 715 Government and Non-Profit Accounting (3)
Prerequisites: permission of department. Basic accounting practices of governmental and nonprofit organizations. Emphasis on presentation of data in assessing an organization's financial health, financial data by organizations, structuring of accounting information to achieve management control, way in which evolving national standards influence kinds of information organizations have to apply in the future.

PUAF 716 State and Local Government Budgeting (3)
Prerequisite: permission of department. State and local government practices as a laboratory for studying public sector financial management.

PUAF 717 Federal Budgeting: Policy and Process (3)
Prerequisite: permission of department. Credit will be granted for only one of the following: PUAF 757 or PUAF 717. Budgeting as a political and administrative instrument of government. Development of budgeting, the multiple uses of the budget, including role in fiscal policy and resource allocation, the roles and relationships of major participants, and effects of resource scarcity on budgeting behavior. Emphasis on the federal level.

PUAF 720 National Security in the Nuclear Age (3)
Prerequisite: permission of department. Examination of issues, choices, and analyses which continue to shape postwar American security policy agenda. Decision for coalition strategy rather than continental defense; adaptation to nuclear revolution at strategic and tactical level; the evolution of forces-in-being; and forward deployments rather than mobilization planning.

PUAF 721 The Structure of Defense Decision Making (3)
Prerequisite: PUAF 720 and permission of department. The security policy process: both in the translation of strategic objectives into operational forces and plans, and in the acquisition of

manpower and material. The analytic base for force sizing; tradeoffs between mobility, readiness, and survivability; the impact of technology; and industrial readiness on weapons acquisition practices.

PUAF 722 Comparative Defense Policies (3)
Prerequisite: majors and permission of department. Comparative politics and public policy orientation to develop different conceptions and approaches to national security. Differing goals and means to think about alternatives to current national and alliance policies. The NATO region as the principal focus.

PUAF 723 Ethics and National Security Policy (3)
Prerequisite: permission of department. Normative and ethical issues raised by the substance and process of U.S. national security decision-making in war and in peace. Ethical choices in the use of military force in pursuit of arms limitation and in conflict termination; the theory of the just war in a nuclear age; and the issues of individual versus collective responsibility.

PUAF 724 Defense Policy Analysis: Quantitative Techniques (3)
Prerequisite: permission of department. The principal analytic approaches and techniques used in national security decision-making. Systems analysis, strategic exchange models, queing theory, cost estimation, manpower models, indicators of defense capability, and campaign analysis.

PUAF 725 Science, Technology and National Security (3)
Prerequisite: permission of department. Technologies of modern warfare and their effects on society. Focus on nuclear arms. Chemical and biological weapons and verification technologies.

PUAF 726 Managing Alliance Relations I (3)
Prerequisite: majors and permission of department. History of NATO alliance and present day concerns.

PUAF 727 Managing Alliance Relations II (3)
Prerequisite: majors and permission of department. Bi-lateral alliances in which one partner is superpower.

PUAF 740 Public Policy and the Environment (3)
Prerequisite: permission of department. Surveys of major federal environmental legislation; the development and implementation of laws, and alternative ways of thinking about the relationship between humans and the environment.

PUAF 750 Topics in Normative Analysis (3)
Prerequisite: PUAF 650 and permission of department. Equity issues in income transfer and health care policies; the role of ideals concerning the environment and equal opportunity as they pertain to regulation; and standards of personal conduct in bureaucratic settings.

PUAF 752 Tactics and Principles of Negotiation (3)
Prerequisite: permission of department. Elements of a 2-person and n-person game theory; the role of time constraints; linkage versus separation of issues. The uses and value of information, types of mediation and arbitration, the design of meetings and procedures of fair division, critical analysis of past and current international negotiations, labor-management, and environmental disputes, supplemented by in-class gaming exercises.

PUAF 754 Operations Research Methods for Policy Analysts (3)
Prerequisites: PUAF 610; and PUAF 611; and permission of department. Basic operations research methods used in public sector decision-making. Network theory and its application to transportation and logistics problems, linear models for planning and production, game theory, and models of conflict with applications to defense policy. Model formulation rather than solution techniques, emphasized through case studies and student presentation of term papers.

PUAF 755 Computers as an Aid to Decision Making (3)
Prerequisite: permission of department. Non-technical treatment of computer usage in public organizations. Designing a system, structures of information systems, data analysis, and displaying

and communicating computer output. The course is not designed for students wishing to develop an expertise in programming or information systems.

PUAF 780 The American Foreign Policy-Making Process (3)
Prerequisite: permission of department. Survey and analysis of the governmental institutions and processes which shape U.S. global engagement on national security and international economic issues. Particular emphasis is given to executive-congressional relations and the broader domestic roots of foreign policy.

PUAF 790 Project Course (3)
Prerequisite: permission of department. Students work in small groups at sponsoring government agency or private firm researching problem of interest to sponsor and relevant to concentration. Emphasis on problem definition, organizing information, and both oral and written presentation of results.

PUAF 798 Readings in Public Policy (1-3)
Prerequisite: permission of both department and instructor. Guided readings for discussions on public policy.

PUAF 899 Doctoral Dissertation Research (1-8)
Prerequisite: permission of department.

RECR – Recreation

RECR 410 Measurement and Evaluation in Recreation (3)
Prerequisite: RECR 130; or permission of department. A survey course in measurement tools and methods and application of measurement to evaluative processes applicable in specific and broad areas of interest and specialization in recreation and parks.

RECR 415 Quantitative Methods (3)
The statistical techniques most frequently used in research pertaining to recreation. An effort will be made to provide students with skills, interpretations and practical applications associated with these techniques.

RECR 420 Program Planning and Analysis (3)
Prerequisite: RECR 130; or RECR 325. Recommended: RECR 220. The essential elements and basic principles involved in the organization and administration of various types of recreation programs with emphasis on the development of practical, comprehensive program plans and evaluations for a population and a facility within the student's particular area of interest.

RECR 421 Campus Leisure Services Programming (3)
An introduction to the various elements of campus leisure services program development. Intramurals, clubs and organizations as well as an analysis of the campus union as a key in the college/university community activity effort.

RECR 426 Industrial Employee Recreation (3)
Prerequisites: RECR 130 or RECR 335. An introductory study of the philosophy of and practices and problems in industrial recreation. Where possible the course will include opportunities for observation and for meeting visiting specialists.

RECR 432 Philosophy of Recreation (3)
A study of the meanings, relationships, and services of recreation as expressed by past and present authorities and leaders. This course should be of interest to people active in education, social work, and related fields.

RECR 440 Leisure Services for the Aging (3)
Prerequisite: RECR 130. Theory and practice in program development of services for the aging. Emphasis on: (1) needs assessment theory and practice; (2) program development; (3) evaluation

theory and practice; (4) leisure service settings for the aging; and, (5) issues confronting providers of services to the aging population.

RECR 450 Camp Management (3)
Prerequisite: RECR 150; or permission of department. An advanced camping course for those students with previous training and experience; organization, administration, programming, current trends, evaluation, and special problems. Whenever possible, visiting specialists and field trips will be included.

RECR 454 Outdoor Education (3)
Field experience and resident camping in an outdoor setting will be used to present the activities and techniques recommended for modern outdoor education practice. Where possible groups of participants will be utilized as subjects for practice instructional work. Activity will emphasize not only the subject matter of science and education but also the broad concepts of conservation, worthy use of leisure time, education for democratic living, etc.

RECR 455 Historical and Natural Interpretation (3)
Prerequisite: RECR 351. Examination of the philosophies of and techniques appropriate to historical and natural interpretation. Analysis and development of interpretive programs and visitor information services. Field trips and laboratory experiences will be required.

RECR 457 Concepts and Issues in Outdoor Recreation (3)
A survey of the relationships between land, leisure and people as increasingly vital and interdependent issues in American civilization. The mainstream of thoughts, methods and policies of resource based recreation, with special attention to the history of conservation and the significance of wilderness.

RECR 460 Leadership Techniques and Practices (3)
Prerequisite: RECR 130. Various types and dynamics of recreation leadership at academic, agency, small and large group levels. Acquisition of tangible techniques, such as goal setting, decision making, and leadership for purposes of organizing, implementing, observing and analyzing human function in organizational settings.

RECR 463 Supervisory Techniques in Recreation (3)
Prerequisite: RECR 130; or RECR 325; or RECR 335. A study of the principles, methods, techniques as well as an analysis of the functions of supervision in the recreation and parks environment. This course is designed to advance the student's understanding of the art of building human relationships, and to apply the emerging concepts and principles of modern supervision to practical situations in which administrators, supervisors, leaders (both professional and paraprofessional) and volunteers are working.

RECR 475 Problems in Therapeutic Recreation (3)
Prerequisite: RECR 375. Problems encountered in the delivery of therapeutic recreation services to individuals with special problems. Current trends, innovative service delivery models, literature review, and identification of funding sources.

RECR 476 Institutional Recreation (3)
Prerequisite: permission of department. An introductory study of the philosophy of and practices in hospital and institutional recreation. Where possible the course will include opportunities for observation and for meeting visiting specialists.

RECR 489 Field Laboratory Projects and Workshop (1-6)
A course designed to meet the needs of persons in the field with respect to workshops and research projects in special areas of knowledge not covered by regularly structured courses.

RECR 490 Organization and Administration of Recreation (3)
A study of the organizational patterns and administrative problems involved in the various types of operating recreation departments and agencies; forms of organization; finance and budget; personnel; public relations.

RECR 493 Tourism and Commercial Leisure Services (3)
A study of the tourism and commercial leisure services industries. Skill in feasibility study and management. Representative types of tourism and leisure services enterprises and their relationships to the public sector.

RECR 495 Recreation Resource and Facility Planning I (3)
Basic principles of planning, design, development, and maintenance of community recreation areas and facilities. The interrelationships between local, regional, state, and national park and recreation systems.

RECR 497 Recreation Resource and Facility Planning II (3)
Prerequisite: RECR 495; or permission of department. Principles of design, development, procedures, and maintenance considerations for recreation areas and facilities. Use of analytical methods to carry out park designs and development of skills in graphically conveying design concepts. Safety, efficiency and economy as they affect design, development and park maintenance.

RECR 498 Special Topics in Recreation (3)
Repeatable if content differs. Prerequisite: permission of department. Topics of special interest in areas not covered by regularly scheduled courses.

RECR 600 Seminar in Recreation (1)
Presentation, discussion and defense of student thesis proposals and outlines and/or of appropriate faculty projects and research activities.

RECR 610 Methods and Techniques of Research (3)
A study of appropriate research methodology including experimental, historical, philosophical, sociological and case study techniques, examples and problems. Each student is required to develop a specimen thesis or dissertation proposal and outline.

RECR 613 Source Material Survey (3)
Study and use of library resources and bibliographical materials of all types through their application to varieties or research problems and interests. Each student carries out special projects of his own initiation.

RECR 633 Foundations of Recreation (3)
Prerequisite: permission of department. A broad study of the sociological, psychological and economic forces that historically have structured attitudes toward leisure and the development of recreation.

RECR 634 Modern Trends in Recreation (3)
A broad study and overview of the recent advances in the several sub areas of recreation: public sector (local, state, federal and international government involvements); therapeutic (for special groups, such as ill, delinquent, aging, etc.); Employee; voluntary agencies; religious organizations; family, school, camping areas; private and commerical sector. Each student will carry out special projects according to his interests.

RECR 660 Group Processes (3)
Prerequisite: permission of department. The diagnosis and improvement of group processes in human relations services administration and practice.

RECR 687 Advanced Seminar (1-3)
Prerequisite: permission of department. Repeatable to 3 credits. Advanced topics in the various areas of recreation.

RECR 688 Special Problems in Recreation (1-6)

RECR 689 Independent Study (1-6)
Special graduate research problems conducted under the direction of a student's advisor.

RECR 690 Administrative Direction of Recreation (3)
This course is concerned with analyzing various problems in the administration of leisure services in parks and other recreational settings. Students concentrate on simulated situations and their own on-the-job problems to enhance their understanding of sound administrative practice and to improve their problem-solving and decision-making abilities.

RECR 700 Advanced Doctoral Seminar (1)
Presentation, discussion and defense of doctoral dissertation proposals and outlines and/or of appropriate faculty projects and research activities.

RECR 799 Master's Thesis Research (1-6)

RECR 899 Doctoral Dissertation Research (1-8)

RTVF – Radio Television and Film

RTVF 402 Advanced Sound Production (3)
Prerequisites: RTVF 302 and permission of department. An advanced sound production methodology in radio drama and documentaries.

RTVF 413 The History of the Film (3)
Recommended: RTVF 314. A survey of the film as an art form. Cinema pre-history, actualities and the Lumiere tradition, Melies, Griffith, and their contemporaries, the silent film (1920-29): Germany, Russia, and the USA, screen comedy, the sound film (1926-present): American and foreign master directors, recent and current trends.

RTVF 414 Contemporary American Cinema (3)
Prerequisite: RTVF 222. Recommended: RTVF 314. For RTVF majors only. Analysis of major trends, styles, and figures in post-World War II American film. Emphasis is on how recent "new wave" directors function in the Hollywood system.

RTVF 415 Contemporary European Cinema (3)
A comparative and critical analysis of European and other national cinemas. Emphasis is on post-World War II figures, movements, and stylistic innovations.

RTVF 417 Screenwriting for TV and Film I (3)
Prerequisites: RTVF 317 or equivalent; and permission of department. Principles of story and character development, theories of drama and comedy, film script format. Course concentrates on plot structure and screenplay form. Students write original treatment and first half of screenplay for film or television. Projects are critiqued in group story and script conferences.

RTVF 418 The Film Auteur (3)
Repeatable to 6 credits if content differs. The intensive chronological study of the work of one European or American film director each semester.

RTVF 419 Film Genres (3)
Repeatable to 6 credits if content differs. The study of one major film genre each semester (the western, science fiction, melodrama, political film). Emphasis is on cultural implications of generic forms.

RTVF 420 The Documentary Film (3)
Growth, implication, and the use of the international nonfiction film as propaganda, public service, promotion, education, and entertainment. Case studies from representative documentaries will be analyzed.

RTVF 421 Film Criticism and Theory (3)
Study of various theoretical models of film analysis and applied critical writing on such topics as montage, mise-en-scene, ideology, feminism, psychoanalysis, and structuralist approaches.

RTVF 424 The Film Industry: History and Technology (3)
The history, status and present functions of the American film industry including the studio system, the innovation of color and sound, distribution and exhibition.

RTVF 425 Television and Politics (3)
Critical review of studies of the effects of political broadcasts; legal and social issues; surveys and media campaigns.

RTVF 427 Screenwriting for TV and Film II (3)
Prerequisites: RTVF 417 or equivalent; and permission of department. Analysis and technique of screenwriting. Complete a dramatic or comedy script for motion pictures or television. Students may complete scripts written in RTVF 417.

RTVF 440 Television Direction (3)
Prerequisites: RTVF 340 and permission of department. Principles of television direction including elements of composition, picturization, timing, script notation and program coordination.

RTVF 441 Television Direction II (3)
Prerequisite: RTVF 440 or permission of department. Advanced theories of television direction; script analysis and adaptation, production coordination, casting, blocking, rehearsals and mixing.

RTVF 447 Quantitative Methods of Broadcast Research (3)
Prerequisite: RTVF 347 or permission of department. An examination of the fundamentals of research methodology as it relates to the study and analysis of broadcast audiences.

RTVF 449 Television Workshop (1-3)
Prerequisite: permission of department. Repeatable to 6 credits. Special studio projects.

RTVF 450 Radio and Television Station Management (3)
The role of the manager in broadcasting industry. Station organization, licensing, regulation, sales, programming, personnel, and promotion are examined in light of the competitive marketplace.

RTVF 451 Broadcast Criticism (3)
An analysis of the professional, historical, social, and psychological criticism of American television, together with practical application of professional and scholarly critical methods.

RTVF 452 International and Comparative Broadcasting Systems (3)
A comparative study of international broadcasting program policies, economic systems, control and organization. The use of broadcasting in international affairs as an instrument of propaganda, culture and information dissemination. Monitoring of overseas broadcasts, television programs and discussions with representatives of domestic and foreign international broadcast agencies.

RTVF 453 Broadcast Regulation (3)
Prerequisite: RTVF 223. Legal issues involving radio and television: freedom, restraints, self-regulation; regulation of programming, competition, rights as seen by the broadcaster, regulatory agencies and the public.

RTVF 454 Cable Television (3)
Prerequisite: RTVF 223. History, regulatory development, system designs, communications capability and franchising of cable television.

RTVF 456 Structure and Criticism of TV Advertising (3)
Prerequisites: RTVF 222; and RTVF 223; and RTVF 317. An examination of the persuasive power of television advertising. Analysis of form, structure and content of the television commercial and techniques used to influence attitudes and behavior.

RTVF 457 Media Economics (3)
Economic issues involving radio, television, film, and new technologies of cable and satellite transmission.

RTVF 466 Film Production III, Synchronized Sound Film Systems (3)
Prerequisites: RTVF 356 and permission of department. Synchronized sound and color technology with emphasis on the 16mm format.

RTVF 467 Film Production IV, Advanced (3)
Prerequisites: RTVF 466 and permission of department. Direction and production of 16mm, color, synchronized sound motion picture. Production management, cinematography, and sound recording.

RTVF 470 Corporate Television (3)
Television and other electronic technologies for corporate communication.

RTVF 498 Seminar (3)
Prerequisite: permission of department. Senior standing. Repeatable to 6 credits. Present day radio-television-film research.

RTVF 600 Introduction to Graduate Study in Broadcasting (3)

RTVF 601 Visual Communication (3)
A theoretical analysis of aspects of perception; effects of visual messages in human communication through television and film.

RTVF 617 Screenwriting I (3)
Prerequisite: permission of instructor. Method, analysis, and techniques of dramatic writing for motion pictures and television. Story plotting, characterization, script structure. Students write original film treatment and major portion of screenplay draft.

RTVF 621 Formal Film Analysis (3)
The elements and composition of intensive analysis of selected narrative films on a shot by shot basis.

RTVF 627 Screenwriting II (3)
Prerequisites: RTVF 617 or equivalent; and permission of instructor. Intensive work on scripts in progress. Completion of full length screenplays or teleplays. Projects are cast, performed and critiqued in class. Students may complete screenplays started in RTVF 617.

RTVF 628 Seminar in Film (3)
Repeatable to 6 credits if content differs. Studies of various aspects of film. Subject matter changed each semester.

RTVF 629 Special Problems in Film (3)
Repeatable to 6 credits if content differs. An experimental course for the development of new ideas in film.

RTVF 642 History of Broadcasting (3)
Seminar study of the individuals, technological developments, and social and economic factors responsible for the development and direction of the broadcast media in the United States.

RTVF 648 Seminar in Broadcasting (3)
Studies of various aspects of broadcasting. Subject matter changed each semester.

RTVF 649 Special Problems in Broadcasting (3)
An experimental course for the development of new ideas in broadcasting.

RTVF 662 Seminar in Political Broadcasting (3)
A seminar integrating the theory of mass communication with rhetorical-critical theory in an analysis of major political uses of the broadcast media.

RTVF 699 Independent Study (1-3)

RTVF 799 Master's Thesis Research (1-6)

RUSS – Russian

RUSS 401 Advanced Russian Composition (3)
Prerequisite: RUSS 302.

RUSS 402 Practicum in Written Russian (3)
Prerequisite: RUSS 401 or equivalent. Designed to improve comprehension of functional varieties of written Russian and develop ability to present in written form concise syntheses of source texts.

RUSS 403 Russian Conversation: Advanced Skills (3)
Prerequisite: RUSS 303 or equivalent. Advanced spoken production of high-level, abstract language.

RUSS 404 Practicum in Spoken Russian (3)
Prerequisite: RUSS 403 or equivalent. To improve comprehension of rapidly spoken Russian of various functional styles and to develop ability to synthesize orally the content of spoken material.

RUSS 405 Russian-English Translation (3)
Pre- or corequisite: RUSS 302 or equivalent. Introduction to the principles of translation of a particular genre, typically diplomatic, business, or literary Russian.

RUSS 409 Selected Topics in Russian Language Study (3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs. Presentation of a topic in Russian language study.

RUSS 410 Applied Russian Linguistics (3)
The nature of applied linguistics and its contributions to the effective teaching of foreign languages. Comparative study of English and Russian, with emphasis upon points of divergence. Analysis, evaluation and construction of related drills.

RUSS 411 Linguistic Analysis of Russian I (3)
Prerequisites: RUSS 210; and LING 200. Pre- or corequisite: RUSS 301. Elucidation of theoretical concepts of modern linguistics through the analysis of problematic concepts in the Russian linguistic system. Phonology and the syntax of the simple sentence.

RUSS 412 Linguistic Analysis of Russian II (3)
Prerequisite: RUSS 411. Continuation of RUSS 411. The syntax of the complete sentence, semantics.

RUSS 431 Russian Literature of the 19th Century I (3)

RUSS 432 Russian Literature of the 19th Century II (3)

RUSS 433 Russian Literature of the 20th Century (3)

RUSS 434 Soviet Russian Literature (3)

RUSS 439 Selected Topics in Russian Literature (3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs. Presentation of a topic in Russian literature.

RUSS 473 Recent History of the Russian Language (3)
Prerequisite: RUSS 210 or equivalent. Linguistic interpretation of Russian texts from the late 18th century to the present.

RUSS 605 Practicum in Russian/English Translation (3)
Prerequisites: RUSS 405 and RUSS 402, or permission of department. Problems of translation in various modes, such as business, law, diplomacy, and literature.

RUSS 606 Advanced Stylistic Analysis of Russian (3)
Prerequisite: RUSS 402 or permission of department. Evaluation of various functional styles of Russian and proficiency in the writing of one of these styles.

RUSS 610 Proseminar in Russian Linguistic Analysis (3)
Prerequisite: RUSS 412 or permission of department. A general orientation to linguistics (including argumentation) and research skills (including basic bibliography, library skills, and field methods).

RUSS 611 Problems in Russian Phonology and Morphology (3)
Prerequisite: RUSS 411 or permission of department. Corequisite: RUSS 610. Treatment of Russian phonetics, phonology (including morphophonemics), and morphology.

RUSS 612 Problems in Russian Syntax (3)
Prerequisite: RUSS 412 or permission of department. Treatment of Russian syntax in the framework of current linguistic theory.

RUSS 613 Problems in Russian Semantics (3)
Prerequisite: RUSS 412 or permission of department. Treatment of Russian lexical and grammatical semantics.

RUSS 618 Special Topics in Linguistic Analysis of Russian (3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs. Aspects of Russian linguistics such as stress, verbal, tense, taste, word order, or problems in lexical semantics.

RUSS 619 Seminar in Linguistic Analysis of Russian (3)
Prerequisites: RUSS 610 and one of RUSS 611, RUSS 612, RUSS 613. Repeatable to 6 credits if content differs. Current research in Russian linguistic analysis.

RUSS 673 History of the Russian Language (3)
Prerequisite: SLAV 475. Introduction to historical Russian grammar and phonological developments in Russian.

RUSS 679 Special Topics in Slavic Linguistics (3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs. Topics concerning contrastive, historical, and dialectical Slavic linguistics, in relation to our understanding of grammatical theory.

RUSS 798 Independent Study (1-3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs.

RUSS 799 Thesis Research (1-6)
Prerequisite: permission of department. Repeatable to 6 credits if content differs.

SLAV – Slavic

SLAV 469 Selected Topics in Slavic Studies (3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs. Presentation of a topic in Slavic studies.

SLAV 475 Old Church Slavonic (3)
Introduction to the language of the oldest recorded Slavic documents. Historical presentation of phonology, morphology, and syntax; reading of texts.

SLAV 479 Selected Topics in Slavic Linguistics (3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs. Presentation of a topic in Slavic linguistics.

SLAV 499 Directed Study (1-3)
Prerequisite: permission of department. For advanced students. Repeatable to 6 credits if content differs.

SOCY – Sociology

SOCY 401 Intermediate Statistics for Sociologists (3)
Prerequisite: SOCY 201 or equivalent, and six additional credits in sociology. Intermediate correlation techniques, analysis of variance, sampling, additional nonparametric techniques, additional topics in inferential statistics.

SOCY 402 Intermediate Procedures For Data Collection (3)
Prerequisite: SOCY 202 or equivalent or permission of department. An intermediate survey of the major research methods used by sociologists, including survey research, experimentation,

observation, archival research, and in-depth interviewing. The selection of an appropriate research method, with analysis of the strengths and weaknesses of various methods, practical issues, data collection and preparation, and analytical techniques.

SOCY 403 Intermediate Sociological Theory (3)
Prerequisite: SOCY 203. Major theoretical approaches e.g., Functionalism conflict, symbolic interactionism, and their implicit methods of logic illustrated by case studies. Original works of major theorists in historical perspective.

SOCY 404 Methods of Quantitative Analysis (3)
Prerequisite: SOCY 202 or equivalent or permission of department. A computer-based approach to the analysis of sociological data. Statistical program packages such as spss, using both card input and computer terminals; data storage and file manipulation. Use of multivariate statistical techniques, national sample surveys, census, and artificial data sets constructed to illustrate specific features of the techniques.

SOCY 410 Population I (3)
Prerequisite: junior standing; SOCY 100 or SOCY 105 not required. Population distribution and growth; sources of demographic data; population composition; population theories; mortality; fertility and family planning; migration; and population problems and policy.

SOCY 411 Population II (3)
Prerequisite: SOCY 410 or permission of department. Introduction to basic techniques for analyzing population change. The measurement of fertility, mortality, and migration.

SOCY 423 Ethnic Minorities (3)
Prerequisite: SOCY 100 or SOCY 105. Basic social processes in the relations of ethnic groups; immigration groups and Blacks in the United States; ethnic minorities in Europe.

SOCY 424 Sociology of Race Relations (3)
Prerequisite: 9 credits in sociology or permission of department. Analysis of race-related issues, with a primary focus on American society. The hisorical emergence, development, and institutionalization of racism; the impact of racism on its victims; and racially based conflict.

SOCY 425 Sex Roles and Social Institutions (3)
Prerequisite: SOCY 325 or permission of department. Relationship between sex roles and the structure of one or more social institutions (e.g., the economy, the family, the political system, religion, education). The incorporation of sex roles into social institutions; perpetuation or transformation of sex roles by social institutions; how changing sex roles affect social institutions.

SOCY 426 Sociology of Religion (3)
Prerequisite: SOCY 100 or SOCY 105. Varieties and sources of religious experience. Religious institutions and the role of religion in social life.

SOCY 427 Deviant Behavior (3)
Prerequisite: SOCY 327 or 12 credits in sociology or permission of department. Current theories of the genesis and distribution of deviant behavior, and their implications for a general theory of deviant behavior. Definitions of deviance, labeling theory, secondary deviance.

SOCY 430 Sociology of Personality (3)
Prerequisite: SOCY 100 or SOCY 105. Development of human nature and personality in contemporary social life; processes of socialization; attitudes, individual differences and social behavior.

SOCY 431 Formal and Complex Organizations (3)
Prerequisite: SOCY 331 or permission of department. The concept of formal organization. The study of functioning and control in the operation of bureaucracies such as corporations and in large-scale organizations such as military, religious and educational hierarchies. Forms of re-

cruitment, internal mobility and organizational personality. Relations between large-scale organizations and with the larger society.

SOCY 432 Collective Behavior (3)
Prerequisite: SOCY 100 or SOCY 105 or SOCY 230 or permission of department. Unlike most sociology courses which focus on structured groups, this course examines instances of transient behavior: crowds, disasters, hysterical contagion, revolution, and social movements, including American Utopian experiments.

SOCY 433 Social Control (3)
Prerequisite: SOCY 100 or SOCY 105. Forms, mechanism, and techniques of group influence on human behavior; problems of social control in contemporary society.

SOCY 440 Sociology of the Self-Concept (3)
The nature of the self-concept and the social forces that mold it. Major sociological, psychological, and psycho-analytic theories of the self-concept. Self-concept motives, mechanisms of self-defense, and the nature of a healthy self-concept. Empirical research dealing with the bearing of social interaction, social structure, social context and social institutions on the self-concept.

SOCY 441 Social Stratification and Inequality (3)
Prerequisite: 6 credits of sociology or permission of department. 56 semester hours. Junior standing. Credit will be granted for only one of the following: SOCY 241 or SOCY 441. The sociological study of social class, status, and power. Topics include theories of stratification, correlates of social position, functions and dysfunctions of social inequality, status inconsistency, and social mobility.

SOCY 443 The Family and Society (3)
Prerequisite: SOCY 343 or permission of department. Study of the family as a social institution; its biological and cultural foundations, historic development, changing structures, and functions, the interaction of marriage and parenthood, disorganizing and reorganizing factors in present day trends.

SOCY 445 Sociology of the Arts (3)
Prerequisite: SOCY 100 or SOCY 105. Functions of the arts as a social institution. Social role of the artist. Recruitment to and organizational structure of artistic professions. Art forms and social characteristics of audiences. Changing technology and changing social values as reflected in artistic expression.

SOCY 447 Small Group Analysis (3)
Prerequisite: SOCY 100 or SOCY 105 or SOCY 201 (sociological statistics) or equivalent. Analysis of small group structures and dynamics. Review of research on small groups in real life settings and in laboratories. Presentation of techniques used in small groups.

SOCY 450 Applied Sociology (3)
Prerequisite: SOCY 201, SOCY 202, SOCY 203. The uses of sociology in non-academic settings. The ethics and social organization of sociological research, the range of applied settings, the development and evaluation of proposals, and the communication of sociological findings to non-sociological audiences.

SOCY 457 Sociology of Law (3)
Prerequisite: SOCY 100 or SOCY 105. Law as a form of social control; interrelation between legal and other conduct norms as to their content, sanctions, and methods of securing conformity; law as an integral part of the culture of groups; factors and processes operative in the formation of legal norms as determinants of human behavior.

SOCY 460 Sociology of Work (3)
Prerequisite: SOCY 331 or permission of department. Analysis of the American work world with special attention to the impact of social change and occupational conflicts on the individual worker. Professionalization, career patterns, problems of minority groups and the future of work.

SOCY 462 Industrial Sociology (3)
Prerequisite: SOCY 331 or permission of instructor. The sociology of human relations in American industry and business. Complex industrial and business organization as social systems. Social relationships within and between industry, business, community and society.

SOCY 464 Military Sociology (3)
Prerequisite: SOCY 100 or SOCY 105. Social change and the growth of military institutions. Complex formal military organizations. Military service as an occupation or profession. The sociology of military life. Relations between military institutions, civilian communities and society.

SOCY 465 The Sociology of War (3)
Prerequisite: SOCY 100 or SOCY 105. The origin and development of armed forces as institutions, the social causes, operations and results of war as social conflict; the relations of peace and war and revolution in contemporary civilizations.

SOCY 466 Sociology of Politics (3)
Prerequisite: 9 credits in sociology. An introduction to the sociology of political phenomena. Consideration of the basic concepts and major findings in the field; the relationship of the polity to other institutional orders of the society; the relationship of political activity in America to the theory of democracy.

SOCY 467 Sociology of Education (3)
Prerequisite: SOCY 100 or SOCY 105 or permission of department. Sociological analysis of educational institutions and their relation to society: goals and functions, the mechanisms of social control, and the impacts of stratification and social change. Study of the school as a formal organization, and the roles and subcultures of teachers and students.

SOCY 470 Rural-Urban Relations (3)
Prerequisite: SOCY 100 or SOCY 105. The ecology of population and the forces making for change in rural and urban life; migration, decentralization and regionalism as methods of studying individual and national issues. Applied field problems.

SOCY 473 The City (3)
Prerequisite: SOCY 100 or SOCY 105. The rise of urban civilization and metropolitan regions; ecological process and structure; the city as a center of dominance; social problems, control and planning.

SOCY 474 Soviet Ethnic Issues (3)
Ethnic processes and issues in the Soviet Union. The major ethnic groups in the U.S.S.R. cultural, political, religious, economic, and other aspects of Soviet ethnicity.

SOCY 498 Selected Topics in Sociology (1-3)
Prerequisite: SOCY 100 or SOCY 105. Repeatable to 6 credits. Topics of special interest to advanced undergraduates in sociology. Such courses will be offered in response to student request and faculty interest.

SOCY 601 Multivariate Statistics (3)
Prerequisite: SOCY 401 or equivalent. Advanced treatment of inferential statistics; sampling; research design; non-parametric techniques; scaling.

SOCY 602 Intermediate Procedures of Data Analysis (3)
Prerequisite: Undergraduate training in sociology research methods, statistics, and and theory or equivalent. This course is designed to provide the graduate student with practical experience in analyzing data. Extensive use of "canned" computer programs is made to analyze available data. Knowledge of computer systems, languages, or applications is not a prerequisite. However, the student is required to have completed an introductory course in research methods and have a basic grasp of multivariate statistics.

SOCY 604 Survey Research Methods (3)
Prerequisite: SOCY 602 or equivalent or permission of department. The design, collection, and analysis of data using the method of the social survey. Comparison of the advantages and disadvantages of the survey method with those of other methods of social inquiry. Control over the major sources of survey variation: survey mode, sampling, questionnaire format, question wording, interviewing and coding. Measurement and multivariate analysis alternatives.

SOCY 605 Methods of Program Evaluation (3)
Prerequisite: SOCY 202 or equivalent or permission of instructor. Survey of research methods used to evaluate social programs. Conceptualization and measurement of program inputs and outcomes; experimental, quasi-experimental and time-series designs for determining causal influence of program; strategies of data analysis.

SOCY 606 Seminar in Field and Qualitative Methods (3)
Prerequisite: six graduate level credits in sociology and permission of instructor. Survey of qualitative research methods, and practice, through small-scale field research, in design, collection of data, and analysis. Use of intensive and unstructured interviews; participation-observ ation; unobtrusive measures; content analysis of personal and public documents. Research with natural groups.

SOCY 607 Research Methods: Data Archives (3)
Prerequisite: SOCY 401 or equivalent or permission of instructor. Secondary data analysis, with emphasis on the use of data archives such as those available from national sample surveys, the census, and international social science research organizations. Research design, computer skills necessary to manipulate large data sets, formulation of hypotheses and interpretation of data. Emphasis on practical experience in locating and using data archives.

SOCY 609 Practicum in Social Research (3)
Prerequisite: permission of instructor. The conduct of research in collection and analysis of social science data under the guidance of experienced investigators. Emphasis on a particular research area of procedure, e.g. secondary analysis of survey data; experimental design; evaluation of research; data collection techniques.

SOCY 618 Computer Methods For Sociologists (3)
Prerequisite: SOCY 400 or SOCY 401 or equivalent and elementary knowledge of a programming language, CMSC 120, CMSC 220 or equivalent and permission of instructor. Designed to present the potential of the computer as a tool in sociological research. Projects involving programming and running of data manipulation techniques, statistical techniques, and simple simulations.

SOCY 620 Development of European and American Sociological Theory (3)
Prerequisite: SOCY 203 or permission of instructor. Review of the history of sociological thought with major attention to the key figures in the early years of the discipline (Marx, Weber, and Durkheim). The development of the major schools of sociological theory.

SOCY 621 Contemporary Sociological Theory (3)
Prerequisite: SOCY 203 or equivalent or permission of instructor. Systematic examination of sociological theory since approximately 1920

SOCY 622 The Sociology of Knowledge (3)
Analysis of the relation of types of knowledge to social structure. Role of social class and social organization in the development of science, political ideology, belief systems and social values. Social roles associated with production of knowledge.

SOCY 623 Survey of Urban Theory (3)
Prerequisite: SOCY 120, SOCY 473 or equivalent. Theoretical approaches of sociology and other social sciences to urbanism, urbanization, and urban phenomena. Selected approaches: chicago school; metropolitan region; demography; institutions.

SOCY 624 Socialization Theory and Research (3)
Emphasis on processes of theory building, utilizing research to compare the efficacy of several theories as they relate to socialization, culminating in a detailed theory of socialization and personality.

SOCY 626 Human Ecology (3)
Review of research and theory in human ecology. Assessment of the ecological complex (population, organization, environment, technology).

SOCY 630 Population and Society (3)
Selected problems in the field of population; quantitative and qualitative aspects; American and world problems.

SOCY 631 Comparative Sociology (3)
Cross-national analysis of selected social institutions.

SOCY 632 Personality and Social Structure (3)
First semester. Comparative analysis of the development of human nature, personality, and social traits in select social structures.

SOCY 633 Sociology of Occupations and Professions (3)
An analysis of the occupational and professional structures of American society, including such topics as changing roles, functions, ideologies and their impact on individuals.

SOCY 634 Attitudes and Public Opinion (3)
Processes involved in the formation of attitudes; effects of communication; measurement techniques.

SOCY 635 Sociology of Law (3)

SOCY 640 Social Change and Social Policy (3)
First semester. Emergence and development of social policy as related to social change, policy-making factors in social welfare and social legislation.

SOCY 641 Family Studies (3)
Second semester. Case studies of family situations; statistical studies of family trends, methods of investigation and analysis.

SOCY 642 The Sociology of Mental Health (3)
Social factors that influence mental health. Group dynamics of mental health preservation.

SOCY 643 Community Studies (3)
Factors affecting community development and growth, social structure, social stratification, social mobility and social institutions; analysis of particular communities.

SOCY 644 Work and the Family (3)
The interrelationships between work and the family for both men and women in contemporary societies. Major research issues addressed from an interdisciplinary and comparative (international) perspective.

SOCY 645 Sociology of the Self Concept (3)
Theory and empirical research dealing with the social determination and social consequences of the self-concept. Sociological, psychological, and psychoanalytic approaches to the self.

SOCY 646 Collective Behavior and Social Movements (3)
Transitory and non-institutionalized social behavior; crowds, mass hysteria, panic, riots; secular and sectarian social reform movements; experimental utopian communities; intensified mass activity with particular relation to dissidence and change; critique of trends in social activism.

SOCY 647 Interpersonal Behavior and Small Groups (3)
Theory and empirical research on small group structure and processes and interpersonal behavior. Social influence, interpersonal attraction. Cohesiveness, power and prestige structures, role differentiation, coalition formation. Laboratory and field methods of investigation.

SOCY 660 Theories of Social Psychology (3)
Prerequisite: undergraduate training in sociological research methods, statistics, and theory or equivalent. An introduction to some of the theories in social psychology that are particularly useful to sociologists. Topics to be covered include theories of cognitive consistency, social exchange, symbolic interaction, role theory, group processes, and collective behavior.

SOCY 661 Social Stratification (3)
Prerequisite: permission of instructor. Major theoretical and research problems in the sociology of social stratification. The characteristics, correlates, and consequences of class and status stratification; the distribution of power; the relationship of social stratification to ideology and the institutional orders of society.

SOCY 662 Theories of Formal Organization (3)
An introduction to the study of organization, the nature of organizations, types of organizations, determinants and consequences of organizational growth, determinants and consequences of growth for administrative staff, determinants of effectiveness and research in organizations.

SOCY 663 Theories of Social Systems (3)
Prerequisite: SOCY 603 or equivalent. Study of systems models: logical, social-psychological and social; types of social systems: ecological, functional, formal, consensual, and historical; levels of social systems: group, complex organization, collectivity and community; methods of study: analytical and empirical, qualitative and quantitative; examples of specific systems: professions, science, politics, cities.

SOCY 664 Armed Forces and Society (3)
Analysis of the relationship between military organization and modern industrial society. Growth and decline of the mass army, the transition from conscription to all-volunteer forces, the social legitimacy of military organization, the military as a form of industrial organization, and problems of civil-military relations in the modern world.

SOCY 665 Sex Stratification (3)
Prerequisite: permission of instructor. Theoretical and empirical literature on social roles of men and women at both the social-psychological and structural levels. Socialization, attitudes, interpersonal behavior, work roles, stratification by race and class as related to gender, social problems related to gender inequality.

SOCY 674 Ethnicity (3)
The theoretical orientations found in the study of ethnicity, the historical emergence and contemporary nature of ethnic communities, selected aspects of interethnic conflict and ethnic revitalization from the personality level to the national ideological level. Primary emphasis on American society.

SOCY 699 Special Social Problems (1-16)

SOCY 700 Theory Construction (3)
Prerequisite: one graduate course each in statistics, sociological theory, and sociological research methods. Review of symbolic logic and the meaning prediction and explanation. The nature of concepts propositions, and axiomatic systems; the use of models; the nature of casuality; fundamental assumptions and variables commonly used in sociological theory. Examples from current theories.

SOCY 701 Issues in the Integration of Theory and Method (3)
Prerequisite: SOCY 401 or equivalent and at least two of the following: SOCY 402, SOCY 604, SOCY 605, SOCY 606, SOCY 607, SOCY 609, SOCY 702 or permission of instructor. The construction of theory, design of research, and interpretation of data, for example, strategies of theory building; the nature of causality; advantages and disadvantages of experimental, survey and case study designs; temporal problems; measurement strategies.

SOCY 702 Intermediate Procedures For Data Collection (3)
Prerequisite: SOCY 202 or equivalent or permission of instructor. Research design including experimental and quasi-experimental designs; measurement problems; reliability and validity; questionnaire construction; scaling; interviewing; the problem of nonresponse; processing and coding of data; preparation of data for analysis.

SOCY 709 Advanced Special Topics in Data Analysis (3)
Prerequisite: permission of instructor. May be repeated for credit with permission of instructor. An intensive examination of an area of interest in data analysis, including such topics as log linear analysis; discriminant function analysis; canonical correlation; factor analysis; analysis of qualitative data; content analysis; mathematical models.

SOCY 719 Advanced Special Topics in Social Psychology (3)
Prerequisite: permission of instructor. May be repeated for credit with permission of instructor. An intensive review of an area of current interest in the field, including such topics as social influence; interpersonal attraction; equity theory; the dramaturgical perspective; stress and coping; interpersonal conflict; the social psychology of large organizations.

SOCY 728 Advanced Special Topics in Meta-theory (3)
Prerequisite: permission of instructor. May be repeated for credit with permission of instructor. An intensive examination of an area of interest in sociological theory, including such topics as paradigm conflicts; philosophy of social science; value issues in sociological theory; formal theory.

SOCY 729 Advanced Special Topics in Substantive Theory (3)
Prerequisite: permission of instructor. May be repeated for credit with permission of instructor. An intensive examination of an area of interest in theory or a school of sociological theory, including such topics as ethnomethodology; structuralism; Marxism and critical theory; historical study of a major sociological theorist such as Marx, Weber, or Durkheim.

SOCY 739 Advanced Special Topics in Organizations and Occupations (3)
Prerequisite: permission of instructor. May be repeated for credit with permission of instructor. An intensive review of an area of current interest in the field, including such topics as managing organizational data sets; problems of industrial democracy; quality of work life; innovation and productivity.

SOCY 749 Advanced Special Topics in Demography (3)
Prerequisite: permission of instructor. May be repeated for credit with permission of instructor. An intensive review of an area of current interest in the field, including such topics as population policy; social and demographic issues in aging; migration; family demography.

SOCY 758 Advanced Special Topics in Sex Roles (3)
Prerequisite: permission of instructor. May be repeated for credit with permission of instructor. An intensive review of an area of current interest in the field, including such topics as labor force participation; comparative studies: sex roles and aging; gender socialization.

SOCY 759 Advanced Special Topics in Sociology of the Family (3)
Prerequisite: permission of instructor. May be repeated for credit with permission of instructor. An intensive review of an area of current interest in the field, such as alternative family life styles, cross-cultural and comparative family studies; victimization (sexual and physical abuse).

SOCY 769 Advanced Special Topics in Military Sociology (3)
Prerequisite: permission of instructor. May be repeated for credit with permission of instructor. An intensive review of an area of current interest in the field, including such topics as women in the military; conscription and national service; organizational change in the military; comparative studies of the military.

SOCY 789 Advanced Special Topics in Social Stratification (3)
Prerequisite: permission of instructor. May be repated for credit with permission of instructor. An intensive examination of an area of interest in the field, including such topics as macrostratification; measurement of prestige; institutional variation in status attainment.

SOCY 799 Master's Thesis Research (1-6)

SOCY 819 Research Seminar in Social Psychology (1)
Prerequisite: permission of instructor. May be repeated for credit with permission of instructor. An advanced research seminar for students preparing to do research or take comprehensive examinations in social psychology.

SOCY 829 Research Seminar in Sociological Theory (1)
Prerequisite: permission of instructor. May be repeated for credit with permission of instructor. An advanced research seminar for students preparing to do research or take comprehensive examinations in sociological theory.

SOCY 839 Research Seminar in Organizations and Occupations (1)
Prerequisite: permission of instructor. Repeatable to 6 credits. An advanced research seminar for students preparing to do research or take comprehensive examinations in organizations or occupations.

SOCY 849 Research Seminar in Demography (1)
Prerequisite: permission of instructor. Repeatable to 6 credits. An advanced research seminar for students preparing to do research or take comprehensive examinations in demography.

SOCY 858 Research Seminar in Sex Roles (1)
Prerequisite: permission of instructor. Repeatable to 6 credits. An advanced research seminar for students preparing to do research or take comprehensive examinations in sex roles.

SOCY 859 Research Seminar in Sociology of the Family (1)
Prerequisite: permission of instructor. Repeatable to 6 credits. An advanced research seminar for students preparing to do research or take comprehensive examinations in sociology of the family.

SOCY 869 Research Seminar in Military Sociology (1)
Prerequisite: permission of instructor. Repeatable to 6 credits. An advanced research seminar for students preparing to do research or take comprehensive examinations in military sociology.

SOCY 889 Research Seminar in Social Stratification (1)
Prerequisite: permission of instructor. Repeatable to 6 credits. An advanced research seminar for students preparing to do research or take comprehensive examinations in stratification.

SOCY 899 Doctoral Dissertation Research (1-8)

SPAN – Spanish

SPAN 401 Advanced Composition (3)
Exercises in practical stylistics, with special emphasis on idiomatic and syntactic structures.

SPAN 402 Advanced Composition (3)
Exercises in practical stylistics, with special emphasis on idiomatic and syntactic structures.

SPAN 408 Great Themes of the Hispanic Literatures (3)
Pervading themes in the literature of Spain or Spanish-America. Each theme will be announced when the course is offered.

SPAN 409 Great Themes of the Hispanic Literatures (3)
Pervading themes in the literature of Spain or Spanish-America. Each theme will be announced when the course is offered.

SPAN 410 Literature of the Middle Ages (3)
Spanish literary history from the eleventh through the fifteenth century. Reading of representative texts. This course covers until the year 1350.

SPAN 411 Literature of the Middle Ages (3)
Spanish literary history from the eleventh through the fifteenth century. Reading of representative texts. This course covers from 1350 to 1500.

SPAN 412 The Romancero (3)
Origin, nature and influence. Extensive reading in each of the respective sub-genres.

SPAN 416 Practicum in Translation V (3)
Prerequisite: SPAN 357 or permission of department. Translation of complete literary texts from Spanish into English. Presentation and comparison of special problems encountered in individual projects.

SPAN 417 Practicum in Translation VI (3)
Prerequisite: SPAN 416 or permission of department. Translation of complete literary texts from Spanish into English. Evaluation of different renditions of the originals. Problems of interpretation and literary analysis, structure and criticism.

SPAN 418 Hispanic Literature in Translation (3)
Repeatable to 6 credits if content differs.

SPAN 420 Poetry of the 16th Century (3)
Prerequisite: SPAN 321 or equivalent. Selected readings and literary analysis.

SPAN 421 Prose of the 16th Century (3)
Prerequisite: SPAN 321 or equivalent. Selected readings and literary analysis.

SPAN 424 Drama of the Sixteenth Century (3)
From the earliest autos and pasos, the development of Spanish drama anterior to Lope de Vega, including Cervantes.

SPAN 430 Cervantes: Don Quijote (3)
Prerequisite: SPAN 321 or equivalent.

SPAN 431 Cervantes: Novelas Ejemplares and Entremeses (3)
Prerequisite: SPAN 321 or equivalent.

SPAN 434 Poetry of the 17th Century (3)
Prerequisite: SPAN 321 or equivalent. Selected readings, literary analysis, and discussion of the outstanding poetry of the period, in the light of the historical background.

SPAN 435 Prose of the 17th Century (3)
Prerequisite: SPAN 321 or equivalent. Selected readings, literary analysis, and discussion of the outstanding prose of the period, in the light of the historical background.

SPAN 436 Drama of the Seventeenth Century (3)
Prerequisite: SPAN 321. Devoted to Lope de Vega, dramatic theory and the Spanish stage.

SPAN 437 Drama of the Seventeenth Century (3)
Drama after Lope de Vega to Calderon de la Barca and the decline of the Spanish theater.

SPAN 440 Literature of the Eighteenth Century (3)
Traditionalism, Neo-Classicism, and Pre-Romanticism in prose, poetry, and the theater; esthetics and poetics of the enlightenment.

SPAN 448 Special Topics in Latin American Civilization (3)
Repeatable to 6 credits if content differs. An intensive study of a selected topic related to Latin American civilization. Conducted in Spanish.

SPAN 449 Special Topics in Spanish Civilization (3)
Repeatable to 6 credits if content differs. An intensive study of a selected topic related to Spanish civilization.

SPAN 452 The Romantic Movement in Spain (3)
Poetry, prose and drama of the Romantic and Post-Romantic periods.

SPAN 454 Nineteenth Century Fiction (3)
Significant novels of the nineteenth century.

SPAN 456 Nineteenth Century Drama and Poetry (3)
Significant dramas and poetry of the Realist Period.

SPAN 460 The Generation of 1898 and Its Successors (3)
Authors and works of all genres of the generation of 1898 and those of the immediately succeeding generation.

SPAN 461 The Generation of 1898 and Its Successors (3)
Authors and works of all genres of the generation of 1898 and those of the immediately succeeding generation.

SPAN 462 Twentieth Century Drama (3)
Significant plays of the twentieth century.

SPAN 464 Contemporary Spanish Poetry (3)
Spanish poetry from the generation of 1927 to the present.

SPAN 466 The Contemporary Spanish Novel (3)
The novel and the short story from 1940 to the present.

SPAN 468 Modernism and Post-Modernism in Spain and Spanish-America (3)
Repeatable to 9 credits if content differs. A study of the most important works and authors of both movements in Spain and Spanish-America.

SPAN 469 Modernism and Post-Modernism in Spain and Spanish-America (3)
Repeatable to 9 credits if content differs. A study of the most important works and authors of both movements in Spain and Spanish-America.

SPAN 480 Spanish-American Essay (3)
A study of the socio-political contents and aesthetic qualities of representative works from the colonial to the contemporary period.

SPAN 481 Spanish American Essay (3)
A study of the socio-political contents and aesthetic qualities of representative works from the colonial to the contemporary period, with emphasis on the essay of the twentieth century.

SPAN 488 Spanish-American Fiction (3)
Representative novels and/or short stories from the Wars of Independence to the present or close analysis of major contemporary works. Subject will be announced each time course is offered.

SPAN 489 Spanish-American Fiction (3)
Representative novels and/or short stories from the Wars of Independence to the present or close analysis of major contemporary works. Subject will be announced each time course is offered.

SPAN 491 Honors Reading Course: Poetry (3)
Supervised reading to be taken by students admitted to the honors program or upon consultation with the instructor.

SPAN 492 Honors Reading Course: Novel (3)
Supervised reading to be taken by students admitted to the honors program or upon consultation with the instructor.

SPAN 493 Honors Reading Course: Drama (3)
Supervised reading to be taken by students admitted to the honors program or upon consultation with the instructor.

SPAN 496 Honors Seminar (3)
Prerequisite: Open to honors students only; permission of department. Required of all students in the honors program. Other students will be admitted on special recommendation. Discussion of a central theme with related investigation by students. Conducted in Spanish.

SPAN 498 Spanish-American Poetry (3)
Main trends, authors and works from the conquest to Ruben Dario.

SPAN 608 Medieval Spanish Literature (3)
Specific authors, genres, and literary periods studied in depth.

SPAN 609 Medieval Spanish Literature (3)
Specific authors, genres, and literary periods studied in depth.

SPAN 610 The History of the Spanish Language (3)

SPAN 611 Applied Linguistics (3)
Nature of applied linguistics and its contribution to the effective teaching of foreign languages. Comparative study of English and Spanish, with emphasis on points of divergence.

SPAN 612 Comparative Romance Linguistics (3)

SPAN 618 Poetry of the Golden Age (3)
Analyses and studies in depth of specific works of specific poets in the sixteenth and seventeenth centuries.

SPAN 619 Poetry of the Golden Age (3)
Analyses and studies in depth of specific works of specific poets in the sixteenth and seventeenth centuries.

SPAN 628 Seminar: the Golden Age in Spanish Literature (3)

SPAN 629 Seminar: the Golden Age in Spanish Literature (3)
Specific authors, genres, literary movements and literary periods of the sixteenth and seventeenth centuries studied in depth.

SPAN 699 Independent Study in Spanish (1-3)
Repeatable to 3 credits. This course is designed to provide graduate students an opportunity to pursue independent study under the supervision of a member of the department.

SPAN 708 The Eighteenth Century (3)
Specific authors, genres, and literary movements studied in depth.

SPAN 718 The Nineteenth Century (3)
Specific authors, genres, and literary movements studied in depth.

SPAN 719 The Nineteenth Century (3)
Specific authors, genres, and literary movements studied in depth.

SPAN 728 The Twentieth Century (3)
Specific authors, genres and literary movements studied in depth.

SPAN 729 The Twentieth Century (3)
Specific authors, genres and literary movements studied in depth.

SPAN 738 The Drama of the Twentieth Century (3)
Specific authors and movements studied in depth.

SPAN 798 Open Seminar (3)

SPAN 799 Master's Thesis Research (1-6)

SPAN 808 Colonial Spanish-American Literature (3)
Didactic and narrative prose and epic, dramatic and lyric poetry; principal works and authors.

SPAN 809 Colonial Spanish American Literature (3)
Didactic and narrative prose; dramatic and lyric poetry.

SPAN 818 National Spanish-American Literature (3)
Characteristics of the national literatures. Romantic and Costumbrista literature. Cauchismo and Indigenismo. Principal works and authors.

SPAN 819 National Spanish American Literature (3)
Characteristics of the national literatures. Romantic and Costumbrista literature. Cauchismo and Indigenismo. Principal works and authors.

SPAN 828 Hispanic Poetry of the Nineteenth and Twentieth Centuries (3)
Specific authors, genres and literary movements studied in depth.

SPAN 829 Hispanic Poetry of the Nineteenth and Twentieth Centuries (3)
Specific authors, genres and literary movements studied in depth.

SPAN 898 Open Seminar (3)

SPAN 899 Doctoral Dissertation Research (1-8)

SPCH – Speech

SPCH 400 Research Methods in Speech Communication (3)
Prerequisites: SPCH 250 and an introductory course in statistics. Philosophy of scientific method; role of theory; research ethics; empirical research methods (measurement, sampling, design, analysis).

SPCH 401 Foundations of Rhetoric (3)
Prerequisite: SPCH 250. Principles and approaches to the theory, criticism, and historical understanding of rhetorical discourse.

SPCH 402 Communication Theory and Process (3)
Recommended: SPCH 250. Philosophical and conceptual analysis of speech communication theories.

SPCH 420 Theories of Group Communication (3)
Prerequisite: SPCH 400 or permission of department. Current theory, research and techniques regarding small group process. Group dynamics, leadership and decision-making.

SPCH 423 Communication Processes in Conferences (3)
Prerequisite: one course in speech communication or permission of department. Group participation in conferences, methods of problem solving, semantic aspects of language, and the function of conferences in business, industry and government settings.

SPCH 424 Communication in Complex Organizations (3)
Prerequisite: SPCH 400 or permission of department. Structure and function of communication within organizations: organizational climate and culture, information flow, networks and role relationships.

SPCH 435 Theories of Interpersonal Communication (3)
Prerequisite: SPCH 400 or permission of department. Major theoretical approaches and research trends in the study of interpersonal communication.

SPCH 450 Classical and Medieval Rhetorical Theory (3)
Prerequisite: SPCH 401 or permission of department. A systematic inquiry into the rhetorical theory of the classical and medieval periods. Aristotle, Cicero, Quintilian, Martianus Capella, Aurelius Augustine, Alberic of Monte Cassino, Geoffrey of Vinsauf, and Robert of Basevorn.

SPCH 451 Renaissance and Modern Rhetorical Theory (3)
Prerequisite: SPCH 450 or permission of department. Survey of rhetorical theory in the renaissance and modern periods-especially in Britain. Wilson, Sherry, Rainolde, Ramus, Bacon, Campbell, Blair, and Whately.

SPCH 453 Rhetorical Foundations of American Socio-Political Life (3)
Rhetorical potential of language forms and strategic discourse to create, perpetuate, and alter patterns of political and cultural behavior. The influence of historical and contemporary American political and cultural discourse on American society.

SPCH 455 Speechwriting (3)
Prerequisite: SPCH 401 or permission of department. Rhetorical principles of speech composition through study of model speeches and through a practicum in speech writing. Emphasis on the application of research in speech writing to various forms and styles of speeches.

SPCH 460 American Public Address 1635-1900 (3)
Prerequisite: SPCH 401 or permission of department. Rhetorical development of major historical movements and influential speakers from 1635-1990. Emphasis on religious movements, the American Revolution, rhetoric leading up to the Civil War, and the rhetoric of the imperialist and populist movements.

SPCH 461 American Public Address in the 20th Century (3)
Prerequisite: SPCH 401 or permission of department. Rhetorical movements and influential speakers from 1900 to the present. Focus on the themes and rhetorical strategies that characterize contemporary rhetorical discourse.

SPCH 462 British Public Address (3)
Prerequisite: SPCH 401 or permission of department. A biographical, textual and critical-rhetorical study of select British speakers and their influence.

SPCH 470 Theories of Listening (3)
Listening process with emphasis on functional analysis of listening behavior.

SPCH 471 Public Communication Campaigns (3)
Prerequisite: SPCH 200 or permission of department. Diffusion theory and its implications for public communication campaigns.

SPCH 472 Theories of Nonverbal Communication (3)
Prerequisite: SPCH 400 or permission of department. Nonverbal communication in human interaction theory and research on proxemics, kinesics and paralanguage as expression of relationship, affect and orientation within and across cultures.

SPCH 475 Theories of Persuasion (3)
Prerequisite: SPCH 400 or permission of department. Bases of persuasion with emphasis on recent experimental developments in persuasion.

SPCH 476 Theories of Language and Communication (3)
A theoretical investigation of speech as significant behavior. Language, linguistic knowledge, meaning, intention, and understanding, as they relate to communication and communication competence.

SPCH 477 Discourse Analysis (3)
Concepts of textual and discourse analysis applied to speech situations.

SPCH 478 Speech Communication Colloquim (1)
Repeatable to 4 credits. Current trends and issues in the field of speech communication, stressing recent research methods. Recommended for senior and graduate student majors and minors in speech communication.

SPCH 482 Intercultural Communication (3)
Prerequisite: SPCH 400 or permission of department. The major variables of communication in an intercultural context: cultural, racial and national differences; stereotypes; values; cultural assumptions; and verbal and nonverbal channels.

SPCH 488 Speech Communication Internship (1-3)
Prerequisites: GPA 2.5 or above; 56 semester hours or more; 12 semester hours or more in SPCH, including SPCH 250, SPCH 400, SPCH 401; and permission of department. Semester hours earned in SPCH 488 do not satisfy SPCH major requirements. Repeatable to 6 credits if content differs. Practical career experience with a speech communication professional.

SPCH 489 Topical Research (1-3)
Prerequisite: permission of department. Repeatable to 6 credits. Individualized research projects conducted with a faculty sponsor.

SPCH 498 Seminar (3)
Prerequisite: permission of instructor. Senior standing. Present-day speech research.

SPCH 600 Empirical Research in Speech Communication (3)

SPCH 601 Historical-Critical Research in Speech Communication (3)
Intense study in critical and historical methodology as applicable to research in speech communication. Emphasis will be placed on the composition and the evaluation of historical-critical studies of significance in the field of rhetorical communication scholarship.

SPCH 628 Organization Communication: Research and Intervention (3)
Prerequisite: SPCH 424 or permission of instructor. Repeatable to 6 credits. The role of the internal and external communication consultant as an organizational change-agent. Emphasis upon data gathered to facilitate the communication development of the organization.

SPCH 652 Contemporary Rhetorical Theory (3)
A study of twentieth century theories of rhetoric. Special attention will be devoted to Richard Weaver, Kenneth Burke, Lloyd Bitzer, Ernest Bormann, Walter Fisher, and the continental theorists of communication such as Chaim Perelman and Jurgen Habermas.

SPCH 655 Seminar in Speechwriting (3)
Theoretical and practical aspects of speechwriting at an advanced level.

SPCH 670 Seminar in Listening Behavior (3)
Prerequisite: SPCH 470 or permission of instructor. A study of research in and measurement of listening behavior.

SPCH 680 Speech Communication Programs in Education and Training (3)
An analysis of instructional development in speech communication. Instructional objectives, strategies and evaluation are applied to educational, corporate and industrial training programs.

SPCH 681 Communication Issues in Human Resource Development (3)
Research in and theory of contemporary communication issues in the human resource development of governmental, corporate, business organizations.

SPCH 682 Seminar in Intercultural Communication (3)
Intercultural communication with an emphasis on the rhetoric of other cultures, barriers to effective intercultural communication, and interracial communication.

SPCH 688 Speech Communication Field Experience (1-6)
Prerequisite: permission of instructor. Applications of speech communication principles and research in professional communication settings.

SPCH 698 Special Problems in Speech Communication (3)

SPCH 720 Seminar in Small Group Communication (3)
Small group communication theory, research, and applications.

SPCH 724 Seminar in Organizational Communication (3)
Prerequisite: permission of instructor. Theories and problems of human communication within, between, and/or among formal organizations will be emphasized.

SPCH 730 Seminar in Health Communication (3)
Communication processes in health care and promotion.

SPCH 758 Seminar in Rhetorical Theory (3)
Prerequisite: SPCH 460, SPCH 461, or SPCH 450. Repeatable to 12 credits if content differs. Examination of selected theories of style drawn from the fields of rhetoric and literature, and analysis of model speeches.

SPCH 760 Seminar in Political Communication (3)
Prerequisite: SPCH 601 or permission of instructor. A blend of theory and practice to integrate rhetorical-critical theory and empirical methods with politics. Practitioners in political communication will be drawn in as resource persons. Students will map the communication strategy for candidates and analyze actual campaign strategies.

SPCH 768 Seminar in Public Address (3)
Repeatable to 12 credits if content differs. An in-depth study of national and international speakers and issues throughout the history of the spoken word. Emphasis will be placed upon the application of rhetorical principles to the analysis of world speakers and their speeches.

SPCH 775 Seminar in Persuasion and Attitude Change (3)
This seminar will concentrate on the problem of making message strategy decisions. Course content will consist of study of both theoretical and empirical research on attitude and attitude change in persuasive communication.

SPCH 776 Seminar in Interpersonal Communication (3)
Interpersonal communication theory, research, and practice.

SPCH 798 Independent Study (1-3)
Prerequisite: permission of instructor. An individual course designed for intensive study or research of problems in speech communication.

SPCH 799 Master's Thesis Research (1-6)

STAT – Statistics and Probability

STAT 400 Applied Probability and Statistics I (3)
Prerequisite: MATH 141. Random variables, standard distributions, moments, law of large numbers and central limit theorem. Sampling methods, estimation of parameters, testing of hypotheses. (Not acceptable toward graduate degrees in STAT, MAPL or MATH.)

STAT 401 Applied Probability and Statistics II (3)
Prerequisite: STAT 400. Point estimation - unbiased and consistent estimators. Interval estimation. Minimum variance and maximum liklihood estimators. Testing of hypotheses. Regression, correlation and analysis of variance. Sampling distributions. Elements of non-parametric methods. (Not acceptable toward graduate degrees in STAT, MAPL, or MATH.)

STAT 410 Introduction to Probability Theory (3)
Prerequisite: MATH 240; and MATH 241. Probability and its properties. Random variables and distribution functions in one and several dimensions. Moments. Characteristic functions. Limit theorems.

STAT 411 Introduction to Stochastic Processes (3)
Prerequisite: STAT 400. Elementary stochastic processes. Renewal process, random walks, branching process, discrete Markov chains, first passage times, Markov chains with a continuous parameter, birth and death processes. Stationary processes.

STAT 420 Introduction to Statistics (3)
Prerequisite: STAT 410 or equivalent. Point estimation, sufficiency, completeness, Cramer-Rao inequality, maximum likelihood. Confidence intervals for parameters of normal distribution.

Hypotheses testing, most powerful tests, likelihood ratio tests. Chi-squared tests, analysis of variance, regression, correlation. Nonparametric methods.

STAT 440 Sampling Theory (3)
Prerequisite: STAT 401 or STAT 420. Simple random sampling. Sampling for proportions. Estimation of sample size. Sampling with varying probabilities. Sampling: stratified, systematic, cluster, double, sequential, incomplete.

STAT 450 Regression and Analysis of Variance (3)
Prerequisite: STAT 401 or STAT 420. One, two, three and four-way layouts in analysis of variance, fixed effects models, linear regression in several variables, Gauss-Markov Theorem, multiple regression analysis, experimental designs.

STAT 464 Introduction to Biostatistics (3)
Prerequisite: One semester of calculus. 56 semester hours. Junior standing. Probabilistic models. Sampling. Some applications of probability in genetics. Experimental designs. Estimation of effects of treatments. Comparative experiments. Fisher-Irwin test. Wilcoxon tests for paired comparisons. Not acceptable for credit towards degrees in mathematics or statistics.

STAT 498 Selected Topics in Statistics (1-6)
Prerequisite: permission of department. Repeatable to 16 credits. Topics of special interest to advanced undergraduate students will be offered occasionally under the general guidance of the MATH/STAT major committee. Students register for reading in statistics under this number.

STAT 600 Probability Theory I (3)
Prerequisite: STAT 410. Probability space, classes of events, construction of probability measures. Random variables, convergence theorems, images of measures. Independence. Expectation and moments, Lebesque integration, spaces, Radon-Nikodym and LP theorem, singular and absolutely continuous measures. Conditional expectations, existence of regular distributions, applications. Probabilities on product spaces, Fubini theorem, Kolmogorov extension theorem, Tulcea product theorem.

STAT 601 Probability Theory II (3)
Prerequisite: STAT 600. Characteristic functions. Bochner's representation theorem. Helly's theorems and Levy's inversion formula. Applications of residue theorem. Infinitely divisible distributions. Kolmogorov's three-series theorem. Law of the iterated logarithm. Arc sine Law. Central limit theorems (Lindeberg-Feller theorem). Weak and strong laws of large numbers. Martingale convergence theorems (for sequences).

STAT 610 Stochastic Processes I (3)
Prerequisite: STAT 601. Separability, measurability, and sample continuity of stochastic processes. Stopping times. Martingales: fundamental inequalities, convergence theorems and their applications, optional sampling, Riesz decomposition, sample function behavior. Processes with independent (orthogonal) increments, Brownian motion. Stationary processes, spectral analysis and ergodic theory.

STAT 611 Stochastic Processes II (3)
Prerequisite: STAT 601. Definition and classification of Markov processes. Properties of transition probabilities, forward and backward equations (boundary conditions), absorption probabilities, strong Markov property, standard processes. Markovian semigroups, extended infinitesimal operator. Sample function behavior. Connections between semigroup approach and sample function approach. Diffusion theory, Ito equation, potential theory, fine topology.

STAT 650 Applied Stochastic Processes (3)
Prerequisite: STAT 410 or MATH 410 with one semester of probability. Basic concepts of stochastic processes. Renewal processes and random walks, fluctuation theory. Stationary processes, spectral analysis. Markov chains and processes (discrete and continuous parameters.) Birth and

death processes, diffusion processes. Applications from theories of queuing, storage, inventory, epidemics, noise, prediction and others.

STAT 698 Selected Topics in Probability (1-4)

STAT 700 Mathematical Statistics I (3)

Prerequisite: STAT 410 or equivalent. Sampling distributions including noncentral chi-squared, t, F. Exponential families, completeness. Sufficiency, factorization, likelihood ratio. Decision theory, Bayesian methods, minimax principle. Point estimation. Lehmann-Scheffe and Cramer-Rao theorems. Set estimation.

STAT 701 Mathematical Statistics II (3)

Prerequisite: STAT 700 or equivalent. Testing hypotheses: parametric methods. Neyman-Pearson lemma. Uniformly most powerful tests. Unbiased tests. Locally optimal tests. Large sample theory, asymptotically best procedures. Nonparametric methods, Wilcoxon, Fisher-Yates, median tests. Linear models, analysis of variance, regression and correlation. Sequential analysis.

STAT 710 Advanced Statistics I (3)

Prerequisite: STAT 421. Recommended Corequisite STAT 600. Statistical decision theory. Neyman-Pearson lemma and its extensions. Uniformly most powerful test. Monotone likelihood ratio. Exponential families of distributions, concepts of similiarity, and tests with Neyman structure. Unbiased tests and applications to normal families.

STAT 711 Advanced Statistics II (3)

Prerequisite: STAT 710. Invariance, almost invariance, and applications to rank tests. Invariant set estimation. Linear models with applications to analysis of variance and regression. Elements of asymptotic theory. Minimax principle and Hunt-Stein theorem.

STAT 720 Nonparametric Statistics (3)

Prerequisite: STAT 700 or equivalent. Order statistics. Nonparametric point and set estimation. Tolerance regions. Invariance principle and its applications. Large sample properties and optimality criteria. Rank statistics, their distributions and moments. U statistics.

STAT 740 Analysis of Variance (3)

Prerequisite: STAT 700 or STAT 420. Linear models, point estimation, testing and confidence ellipsoids under normal theory. One-way layout, two-way layout and higher layouts. Topics in experimental design: Latin squares, analysis of covariance, factorial designs. Random effects models, mixed models. Emphasis is placed upon the mathematical theory of the general linear model which contains regression analysis as a special case.

STAT 750 Multivariate Analysis (3)

Prerequisite: STAT 420 or STAT 700. Multivariate normal, Wishart's and Hotelling's distributions. Tests of hypotheses, estimation. Generalized distance, discriminant analysis. Regression and correlation. Multivariate analysis of variance; distribution of test criteria. Principal components, canonical correlations and factor analysis.

STAT 770 Analysis of Categorical Data (3)

Prerequisite: STAT 420, STAT 450 and some knowledge of FORTRAN. Loglinear and logistic models. Single classification, two-way classification; contingency tables; tests of homogeneity and independence models, measures of association, distribution theory. Bayesian methods. Incomplete contingency tables. Square contingency tables - symmetry. Extensions to higher dimensional contingency tables.

STAT 798 Selected Topics in Statistics (1-4)

STAT 799 Master's Thesis Research (1-6)

STAT 899 Doctoral Dissertation Research (1-8)

TEXT – Textiles

TEXT 400 Research Methods (3)

Prerequisite: MATH 110 or MATH 115. Not open to students who have completed CNEC 400 or BMGT 230. Research methodology in textiles and consumer economics, with particular

emphasis on the application of statistical concepts and techniques to the analysis of data from the areas of textiles and consumer economics.

TEXT 420 Apparel Design: Draping (3)
Six hours of laboratory per week. *Prerequisites: APDS 101 or ARTT 100; and TEXT 222. Recommended: ARTT 110.* Students explore pattern design through draping on the human form. Emphasis is on the interrelationship between material, design and form.

TEXT 425 Advanced Apparel Design (3)
Six hours of laboratory per week. *Prerequisites: APDS 101 or ARTT 100; TEXT 305 and TEXT 222.* The integration of apparel design skills and principles in solving problems in apparel production, merchandising, and in clothing for special needs.

TEXT 430 Portfolio Presentation (3)
Six hours of laboratory per week. *Prerequisites: [TEXT 420; and TEXT 425] or permission of department. Senior standing. For TEXT majors only.* Problems of apparel design and professional presentation of solutions.

TEXT 435 Woven Fabric Structures and Design (3)
Two hours of lecture and three hours of laboratory per week. *Prerequisite: TEXT 235. Senior standing. For TEXT majors only.* Use of computers to study the construction and combination of simple and complex weaves, the strutures of standard classes of cloths and the application of color to woven fabrics.

TEXT 441 Clothing and Human Behavior (3)
Prerequisites: PSYC 100; and SOCY 100. An exploration of socio-psychological approaches to the study of clothing in relation to human behavior. Social and psychological theories will be examined as possible framework for the study and investigation of clothing.

TEXT 452 Textile Science: Chemical Structures and Properties of Fibers (3)
Two hours of lecture and four hours of laboratory per week. *Prerequisite: CHEM 104 or permission of department.* The chemical structure, properties and reactions of the major classes of natural and man-made fibers. The relationship between molecular structure and physical properties of fibers and fabrics. Laboratory includes chemical identification of fibers, preparation of selected fibers and examination of chemical reactions and properties of fibers.

TEXT 454 Textile Science: Finishes (3)
Two hours of lecture and four hours of laboratory per week. *Prerequisite: TEXT 452 or permission of department.* A study of the chemical reactions and mechanisms involved in imparting water repellance, crease resistance and crease recovery properties, shrink-resistance, flame resistance, soil-release properties and moth and mildew resistance to textile materials. Properties of the finished material which affect its end-use. The application of finishes, identification of finishes and a study of the properties of finished fabrics.

TEXT 456 Textile Science: Dyes and Dye Application (3)
Two hours of lecture and four hours of laboratory per week. *Prerequisite: TEXT 452 or permission of department.* Examination of the principles and techniques of dyeing and printing of textile materials. Properties of the finished products which affect their end-use.

TEXT 470 Textile and Apparel Marketing (3)
Prerequisite: BMGT 350 or permission of department. Analysis of the production, pricing, distribution, and promotion of fibers, yarns, fabrics and textile products by end use. Identification of target markets and development of marketing strategies. Application of case study method to problems of textile and apparel firms.

TEXT 488 Senior Honors Thesis (1-4)
For undergraduate students in the departmental honors program only. An independent literary, laboratory of field study, conducted throughout the student's senior year. Student should register in both fall and spring.

TEXT 498 Special Studies (2-4)
Independent study by an individual student or by a group of students in advanced work not otherwise provided in the department. Students must prepare a description of the study they wish to undertake. The plan must be approved by the faculty directing the study and the department chairman.

THET – Theatre

THET 415 Playwriting (3)
The writing of a one-act and a full-length play.

THET 420 Acting III (3)
Prerequisites: THET 120; and THET 221; and THET 320; and permission of department. Emphasis on the philosophical basis and techniques necessary for acting modern realistic drama and acting period style dramas. In-depth study of Stanislavski System and application of those techniques toward performance in scenes. Examination and application of the techniques necessary for the preparation and performance of an acting score for performing Shakespeare. Improvisation. Required attendance at live theatre productions.

THET 421 Movement for Actors (3)
Prerequisite: permission of department. Studies and intensive exercises to aid the acting student in understanding physical and emotional energy flow, body placement, alignment and body image. The physical aspects of character.

THET 429 Actor's Studio (1-3)
Prerequisite: permission of department. Repeatable to 6 credits. Participation in dramatic roles executed under faculty supervision in the department's productions. Eligible students must make commitments and plan performances with course instructor during pre-registration.

THET 430 Play Directing II (3)
Prerequisite: THET 330 or permission of department. Discussion of the preparation procedures and rehearsal practices necessary for the presentation of a variety of theatrical styles and forms. Emphasis on understanding the relationship between the director, the actor, the script and the audience. A series of student directed scenes supplemented by attendance at theatre productions.

THET 451 Musical Comedy Workshop (3)
Prerequisite: permission of department. Development of the ability to move, act and express through the media of lyric and music.

THET 460 Theatre Management I (3)
Prerequisites: THET 110; and THET 111 or permission of department. The practical tools of theatre management: production philosophies, selecting and balancing a season, tickets and box office procedures, budgeting, graphic arts production, advertising, publicity and other promotional devices.

THET 461 Theatre Management II (3)
Prerequisite: THET 460 or permission of department. Case studies, discussions, lectures and projects concerning advanced theatre management decision making and administration, including such areas as personnel relations, contract negotiations, theatrical unions, fund raising, touring, audience development and public relations.

THET 471 Scenic Design II (3)
Prerequisite: THET 170, THET 273, THET 375, or permission of department. Study of period styles and techniques in scenic design. Emphasis on individual projects and multi-use theatres.

THET 473 Scene Painting (3)
Prerequisite: permission of department. Scene painting techniques and materials. Three-dimensional realistic scenery and non-realistic two-dimensional backdrops. Individual projects.

THET 474 Stage Management (3)
Prerequisite: THET 170 or permission of department. Intensive practical study of the techniques and procedures for stage management. Independent projects dealing with the production of shows.

THET 475 Stage Decor (3)
Prerequisite: THET 170 or permission of department. A study of environmental decor, ornaments and properties through the ages and their practical reproduction for a theatrical production.

THET 476 Lighting Design I (3)
Prerequisites: THET 170; and permission of department. Recommended: THET 273. A study of the theories of electrification, instruments, design, color, and control for stage and television. Brief survey of sound for the theatre. Practical work on productions.

THET 477 Lighting Design II (3)
Prerequisites: THET 476; and permission of department. Study of history and theory of lighting design. Design exercises in proscenium, in-the-round, thrust, outdoor pageant, circus, concert, spectacle, dance and television lighting. A survey of lighting companies and equipment and architectural lighting.

THET 479 Theater Workshop (1-3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs. Supervised participation in the areas of assistant directing, scenic design and properties, costuming or make-up, lighting, technical theatre, stage management, sound.

THET 480 Stage Costume History and Design I (3)
Basic principles of theatre costume design and introduction to rendering skills. Emphasis on development of design conception, unity, character statement, basic clothing design and period style adaptation.

THET 481 Stage Costume History and Design II (3)
One hour of lecture and six hours of laboratory per week. *Prerequisites: THET 480; and permission of department.* An advanced study of costume design and interpretation leading to understanding and facility in design of stylized productions. Emphasis on design for musical comedy, dance theatre, opera and various non-traditional forms of theatre production.

THET 486 Stage Costume Construction I (3)
Study and practical experience in garment construction and related costume crafts as used in theatre costume design. Flat pattern development, textiles, theatrical sewing techniques and organization of the costume construction process.

THET 487 Stage Costume Construction II (3)
Prerequisite: permission of department. Study and practical experience in the construction of stage costumes, props and accessories. Pattern development by draping, millinery, corsets, masks, jewelry, armor and period footwear.

THET 490 History of the Theatre I (3)
Evolution of the theatre from primitive origins, through the early Renaissance with emphasis on playwrights and plays, theatre architecture and decor, and significant personalities. Extensive use of graphic material, play reading, related theatre-going.

THET 491 History of the Theatre II (3)
A continuation of THET 490 beginning with the 16th century and progressing into the 20th, examining the late Renaissance, Elizabethan, Restoration, 17th to 19th century European, and early American theatres. Emphasis on dramatic forms and styles, theatre architecture and decor, and significant personalities. Extensive use of graphic material, play reading, related theatre-going.

THET 495 History of Theatrical Theory and Criticism (3)
The development of theatrical theory and criticism from the Greeks to the modern theorists. The philosophical basis of theatre as an art form. Important theorists and the practical application of their theories in either play scripts or theatrical productions. Required attendance at selected live theatre productions.

THET 499 Independent Study (1-3)
Prerequisite: permission of department. Repeatable to 6 credits. An independent study course in which each student completes an assigned major theatre project under close faculty supervision. Projects may culminate with term papers, scenic or costume designs, or a stage production.

THET 600 Introduction to Graduate Study in Theatre (3)

THET 603 The Aesthetics of Theatre Arts (3)

THET 604 Development of Theatricalisms (3)
Study of theatricalisms from classicism through collectivism.

THET 607 Criticism in the Public and Communicative Arts (3)

THET 610 The American Theatre (3)

THET 611 Trends and Opportunities in Modern Theatre (3)

THET 625 Shakespearean Acting (3)
Prerequisite: permission of department. Study and practice of Shakespearean acting.

THET 626 Advanced Acting Ensemble in Styles I (3)
Prerequisite: permission of department. Performance of comedy, using the works of Moliere and George Bernard Shaw.

THET 627 Advanced Acting Ensemble in Styles II (3)
Prerequisite: THET 626 or permission of department. Performance of serious contemporary drama using works of Chekhov and Pinter.

THET 630 The Performing Arts: Contextual Approach (3)
The common contextual approach to criticism and research in theatre.

THET 650 Directing and Performing in Musical Theatre (3)
Prerequisite: permission of department. Selection, production, direction and performance in musical theatre through class and studio theatre presentations.

THET 660 Theatre Management (3)
The relationship between professional theatre management and educational theatre management. The goals and responsibilities of theatre management in terms of planning, supervision and communication.

THET 669 Independent Study (1-3)

THET 670 Historical Studies in Theatrical Architecture and the Scenic Arts (3)
Studies of the origin of the physical theatre and stage scenery from pre-Grecian ritual to establishment of the modern theatre plant and theatre practices.

THET 671 Theory of Visual Design in Theatre Forms (3)
A historical and theoretical study of the development of theatre forms with an emphasis on the relationship of the form to the production.

THET 672 Theory of Visual Design in Scenery (3)
A historical and theoretical study of design practices in performing arts with an emphasis in scene design and interpretation.

THET 675 Theory of Visual Design in Lighting (3)
A historical and theoretical study of design practices in performing arts with an emphasis in lighting design and interpretation.

THET 678 Theory of Visual Design For the Performing Arts (3)
Prerequisite: THET 375 or permission of department. A historical and theoretical study of design practices in the performing arts.

THET 681 Theory of Visual Design in Costuming (3)
A historical and theoretical study of design practices in performing arts with an emphasis in costume design and interpretation.

THET 688 Special Problems in Drama (3)
The preparation of adaptations and other projects in dramaturgy.

THET 689 Theories of the Drama (3)
Advanced study of the identification and development of dramatic form from the early Greek drama to contemporary forms; the aesthetics of theatre arts; and dramatic criticism.

THET 690 Historical Studies in Greek and Roman Theatre (3)
The ancient theatre from the earliest Greek origins through Roman origins and collapse.

THET 691 Historical Studies in Medieval Theatre (3)
The origin, development and practice of the medieval theatre.

THET 692 Historical Studies in Renaissance Theatre (3)
An investigation of varied elements of the Renaissance related to the theatre arts, the influence of the Renaissance on the theatre, and general theatre practices that originated in this period.

THET 693 Historical Studies in Elizabethan Theatre (3)
A study of the Elizabethan era to gain a clear understanding of drama and theatre at that time.

THET 694 Historical Studies in Modern Theatre (3)
An historical survey of production styles.

THET 698 Seminar: Studies in Theatre (3)
Research projects adapted to individual backgrounds and special work.

THET 699 The Theory of Pre-Modern Dramatic Production (3)
An historical survey of production styles.

THET 788 Master's Tutorial (1-6)
Prerequisite: permission of instructor. Collaboration with a faculty member on joint creative and artistic projects.

THET 789 Master's Practicum (1-6)
Prerequisite: permission of instructor. Participation in creative and artistic activities with professional level theatrical organizations.

THET 799 Master's Thesis Research (1-6)

TXCE – Textiles and Consumer Economics

TXCE 600 Research Methods (3)
Prerequisite: basic course in statistics. Methods of data collection and analysis in textiles and consumer economics. Regression, analysis of variance and non-parametric techniques. Preparation of a research paper which involves some computer applications.

TXCE 608 Special Problems (1-3)
Repeatable to 6 credits if content differs. Credit according to time scheduled and organization of the course. The course may be organized as a lecture series on a specialized advanced topic or may consist of an experimental problem other than the student's thesis topic.

TXCE 610 Economics of Consumption (3)
Prerequisite: ECON 306 or permission of department. Economic analysis of consumer decision-making at the individual and aggregate levels. The economic theory of consumer behavior, markets for consumer goods and services, the economics of consumer protection, income distribution and maintenance programs and consumer expenditures in the U.S.

TXCE 612 Economics of the Family (3)
Prerequisite: ECON 406 or equivalent. Theory of consumer behavior based on the production/consumption decisions of families and households. Household production function, time use, the division of labor in families, the value of household work and the economics of fertility.

TXCE 620 Consumer Behavior (3)
Prerequisite: CNEC 437 or permission of department. An application of the behavioral sciences to a study of consumer behavior. Estimation and critique of current theories of consumer behavior.

TXCE 625 Research Methods in Consumer Behavior (3)
Pre- or corequisite: TXCE 600. Application of research methodology in the behavioral sciences to the study of consumer behavior. Measurement of variables, sampling and survey methodology, correlational research and experimental design.

TXCE 638 Advanced Topics in Consumer Economics (2-3)
Repeatable to 6 credits if content differs. A lecture/discussion series on a specialized advanced topic.

TXCE 639 Seminar in Consumer Economics (1-3)
Repeatable to 6 credits if content differs. A critical discussion of current research literature in the field.

TXCE 640 Historiography of Costume and Textiles (3)
Directed readings in history of costume and textiles. The location and use of primary sources, choice of methods used and critical evaluation of recent work in the field.

TXCE 642 Management of Textile and Costume Collections (3)
Theoretical and practical aspects of the management of costume and textile collections in universities and museums. Emphasis on collection policy and planning, information management and conservation.

TXCE 645 Fabric Structures (3)
Prerequisite: permission of department. Classification of fabric structures and methods of manufacturing, describing and analyzing non-woven, knitted and woven structures. Use of computers in designing fabrics.

TXCE 648 Seminar in Historic Textiles (1-3)
Repeatable to 6 credits if content differs. In-depth studies of selected areas of historic textiles and/or historic textile products, together with their relationships to the cultures and societies of man.

TXCE 649 Seminar in Clothing and Human Behavior (3)
Repeatable to 6 credits if content differs. An examination of theories and research concerned with the relation between clothing and human behavior. Special emphasis will be placed on research techniques.

TXCE 650 Textile Economics (3)
Prerequisite: TEXT 375 or permission of department. Economic analysis of the textile, apparel and fiber industries. Factors affecting the production, marketing and consumption of textile products. International trade in textile products.

TXCE 652 Textile Marketing (3)
Prerequisite: TEXT 470 or permission of department. Analysis of product, pricing, promotion and distribution strategies of textile, apparel and home furnishings firms in the domestic and foreign markets. Evaluation of firm performance, using case-study method.

TXCE 658 Advanced Topics in Textiles (2-3)
Repeatable to 6 credits if content differs. A lecture/discussion series on a specialized advanced topic.

TXCE 659 Seminar in Textiles (1-3)
Repeatable to 6 credits if content differs. A critical discussion of current research literature in the field.

TXCE 660 Fiber Structure and Properties (3)
Prerequisite: TEXT 452 or permission of department. A study of the chemical and physical structure of fiber-forming polymers as they affect the performance of textile materials. Emphasis on structure/property relationships.

TXCE 661 Dyes and Dye Application (3)
Two hours of lecture and four hours of laboratory per week. *Prerequisite: TXCE 660 or permission of department.* Principles and techniques of dyeing and printing textile materials. Properties of the finished products which affect end-use.

TXCE 662 Finishes and Finish Application (3)
Two hours of lecture and four hours of laboratory per week. *Prerequisite: TXCE 660 or permission of department.* Principles and techniques of applying finishes to textile materials. Properties of the finished products which affect end-use.

TXCE 670 Appearance and Sensory Properties (3)
Two hours of lecture and three hours of laboratory per week. *Prerequisite: TEXT 305 or permission of department.* Advanced study of the principles and concepts involved in the laboratory evaluation of appearance, colorimetry, soiling and detergency and other sensory properties of textile materials.

TXCE 671 Mechanical and Thermal Properties (3)
Two hours of lecture and three hours of laboratory per week. *Prerequisite: TEXT 305 or permission of department.* Advanced study of the principles and concepts involved in the laboratory evaluation of mechanical properties (strength, abrasion, wear) and thermal properties (flammability, heat) of textile materials.

TXCE 699 Research Seminar (1)
Repeatable to 2 credits. Seminars on various topics in textiles and consumer economics. Colloquia by graduate students, faculty and visiting speakers.

TXCE 700 Consumption Analysis (3)
Prerequisites: TXCE 600; and permission of department. Application of economic and statistical theory to the measurement of consumer demand. Single equation models and complete demand systems, dynamic demand models, and qualitative response models. Specification, estimation and interpretation of these models.

TXCE 710 Public Policy and the Consumer (3)
Prerequisite: ECON 306 or permission of department. The application of economic theory to an evaluation of policy decisions which affect the consumer. The economic, social and political framework within which policy decisions are made. The need for social intervention and government regulation and economic evaluation of policy decisions including cost effectiveness and cost-benefit analyses.

TXCE 747 Comfort and Perception (3)
Prerequisite: TXCE 670 or permission of instructor. Formerly TXCE 647. Physical, psychological and environmental factors that affect the perceptual response of the human being to different fiber and clothing systems.

TXCE 760 Physics and Chemistry of Fibers (3)
Prerequisite: TXCE 660 or permission of department. The physical and chemical structure of textile fiberforming polymers. The physical, thermal, electrical and optical performance properties of textile fibers and structures relative to fine fiber structure and polymer properties.

TXCE 770 Textile Microscopy (3)
Two hours of lecture and four hours of laboratory per week. The theory and practice of fiber and textile microscopy.

TXCE 789 Non-Thesis Research (1-3)
Directed graduate study which forms the basis of a non-thesis research paper.

TXCE 799 Master's Thesis Research (1-6)

TXCE 899 Doctoral Dissertation Research (1-8)

URBS – Institute for Urban Studies

URBS 410 The Development of the American City (3)
The evolution of the American city and American city planning. Ways in which the interests and ideologies of American city planners have shaped and responded to urban development in the U.S.

URBS 420 Seminar in Urban Literature (3)
Prerequisite: two URBS courses or permission of department. The works of several of the major 20th century writers in urban studies. A comparative analysis of the perspectives of these writers on theoretical and substantive urban issues, is a basis for more advanced study in the theory and process of urbanization.

URBS 438 Urban Internship (1-6)
Prerequisite: permission of department. Repeatable to 6 credits. Supervised field training in urban-oriented programs. Emphasized areas of interest are (1) neighborhoods and communities, (2) organizations and agencies, (3) specific programs. The student will be assigned to a specific agency or project and will be responsible to that agency. Class meetings, written reports, instructor conferences, and a student's critique of his experience are included.

URBS 440 City and Regional Economic Development (3)
Prerequisite: URBS 210 and ECON 105, or ECON 201, or ECON 205. Emphasis on urban finance and causes of urban fiscal stress, the spatial patterns of employment and population, urban labor markets, and models of urban and regional growth and decline. Focus on application of economic theory and urban planning techniques to issues of public service delivery, local economic development, and land use planning.

URBS 450 Problems in Urban Law (3)
Recommended: six credits in URBS courses. A survey of the urban legal environment and special legal problems of urban governments and public interest lawyers. Problems related to planning, zoning, eminent domain and land use controls; consumer protection in central cities; housing codes and multiple dwelling regulation; public accommodations and civil rights ordinances; defending the indigent; and welfare delivery systems.

URBS 460 Urban and Regional Planning in Developing Countries (3)
The theoretical issues of spatial development from a comparative urbanization perspective and analysis of multiple problems facing cities in developing countries. Current government planning policies and interventions.

URBS 470 Management and Administration of Metropolitan Areas (3)
Management and administration of local governments in metropolitan areas with emphasis on cities, counties and special districts in urban areas. Urban governmental organizations, management styles and service delivery. Contemporary problems confronting urban local governments.

URBS 480 Urban Theory (3)
Contemporary theories of the city as a physical and an institutional system. Urban theory as integration of information involving economic, political, and social dimensions of contemporary cities.

URBS 488 Selected Topics in Urban Studies (1-3)
Prerequisite: permission of department. Repeatable to 6 credits if content differs. Topics of special interest to advanced urban studies students.

URBS 498 Honors Seminar in Selected Topics (3)
Prerequisite: admission to honors program in URBS or other departments. Repeatable to 6 credits if content differs. Individual reading and research, and group discussion dealing with selected major contemporary urban issues: Philosophy and growth of new towns; emergent forms of urban policy; federal legislation and the cities; citizen attitudes toward metropolitan government; housing abandonment, rehabilitation, and new construction; the urban future; major world capitals; and urbanization in developing nations.

URBS 499 Honors Thesis (3-6)
Prerequisite: admissions to honors program in URBS or other departments. Individual reading and research, and the writing of an original paper on an urban topic of the student's choice under the guidance of a faculty member.

URBS 601 Urban Research Methods: Multivariate Statistics (3)
Prerequisite: URBS 350 or equivalent. Multivariate statistical analysis for urban problem solving and research. Linear and non-linear correlation and regression, factor analysis, cluster analysis. Social science research methodology. Applications, computer software.

URBS 602 Urban Research Methods: Modeling Applications (3)
Prerequisite: URBS 601. Mathematical and spatial models used in urban research, planning, decision-making. Descriptive and normative models. Aggregate and disaggregate models. Computer software, algorithms, information systems.

URBS 630 Urban Economics and Policy Analysis (3)
Prerequisite: URBS 440 or equivalent. Urban problem and policy analysis in the context of urban spatial patterns and trends and urban public sector organization, finance and operation. Education, zoning and land use planning, fiscal diversity and equal opportunity, new communities, the future of the central city, and alternative institutions for the future.

URBS 640 Urban Demography (3)
Analysis of land-use patterns and demographic characteristics. Examination of changes in these relations and their influence on institutional structures. Study of dynamics of transactions and flows between localities. Metropolises as examples of exchange systems. Problems in indicator development which define the demographic and ecological characteristics. Policy implications f data banks based on indicator information. Social indicators for metropolises as predictors of future development.

URBS 656 Program Planning and Management (3)
Generic planning methods in the management of innovative and developmental programs in large complex urban-area organizations. Needs assessment, knowledge exploration, proposal development, grantsmanship, practical program implementation, program evaluation and program transfer.

URBS 660 Function and Structure of Metropolitan Areas (3)
Theoretical and historical examination of basic urban functions. Intra-metropolitan location of activities. Role of metropolitan planning in a market economy. Examination of cases of metropolitan planning to assess alternative strategies for future metropolitan development.

URBS 666 Urban Management: Personnel, Budgeting and Planning (3)
Prerequisite: URBS 470 or permission of department. Assessment of approaches for rationalizing management in metropolitan-area organizations. Organizational development and management control over urban programs and services. Decision-making approaches available to managers.

URBS 670 Urban Public Policy Analysis (3)
Prerequisite: URBS 470 or permission of department. The process and structures of policy-making and implementation in urban settings. Systematic study of policy outputs through various quantitative indicators of the distribution and delivery of public goods to indicate who decides, on what grounds, who will get how much of what - and why? Discussion and application of urban indicators.

URBS 680 Environmental and Land Use Planning (3)
An overview of planning processes needed by the urban administrator and researcher. The elements and techniques of the planning process, and the institutional setting in which planning takes place.

URBS 683 Social Planning and Community Development (3)
Operational aspects of social planning in communities. Models such as those which view social planning as (1) the delivery of social services, (2) a comprehensive approach to community socio-economic and political development, and (3) advocacy of the interests of the disadvantaged. Methods by which the social planner develops the legitimacy and power to catalyze a community to seek and achieve social change.

URBS 688 Recent Developments in Urban Studies (3)
Examination of selected current aspects of the rapidly evolving field of urban affairs, including for example, trends revealed by the 1980 census, evaluation of model cities, "new towns" in the United States.

URBS 689 Internship Seminar (3-6)
Prerequisite: permission of department. A seminar combined with a field internship with an approved urban planning or management office or organization. The internship field supervisor as well as the assignment must be approved by the professor and the Director of the Institute. A minimum of two days a week must be spent on the field assignment. The seminar will stress the application of urban and administrative theory to the actual urban environment.

URBS 690 Manpower and Employment Policy Planning (3)
Prerequisite: URBS 440 or permission of department. U.S. policy and programs since 1946. Comparison with foreign concepts and experience. Analysis of technological, social patterns and trends. Alternative public policies.

URBS 691 Politics and Planning (3)
Examination of the practice of planning as a technical and a political role. Attitudes of planners toward plan implementation. Development of effective roles for professional planners.

URBS 698 Independent Study in Urban Topics (3)
Directed research and study of selected aspects of urban affairs.

URBS 702 Planning Profession and Practicum (3)
Two hours of lecture and two hours of laboratory per week. *Prerequisite: permission of department.* The planning profession, its history, purpose, organizational structure and value system.

URBS 704 Urban Planning Workshop (5)
16 hours of laboratory per week. *Prerequisite: permission of department.* Simulated practical planning problems. Skills in graphics and communication techniques.

URBS 799 Master's Thesis Research (1-6)

WMST – Women's Studies

WMST 400 Theories of Feminism (3)
Prerequisite: WMST 200 or WMST 250. A study of the multiplicity of feminist theories which have been developed to explain women's position in the family, the workplace, and society.

Major feminist writings are considered in the context of their historical moment and in the context of the intellectual traditions to which they relate.

WMST 490 Feminist Reconceptualizations (3)
Prerequisite: WMST 200 or WMST 250; and WMST 400. Focuses on the ways in which feminist thinking not only changes the content of the various disciplines by including woman as subject, but also leads us to alter the questions we ask, the methods we use, and the ways we come to learn, know and teach. Explorations will be centered around a specific integrative theme.

WMST 498 Special Topics in Women's Studies (1-3)
Prerequisite: WMST 200 or WMST 250 or permission of department. Repeatable to 6 credits.

WMST 499 Independent Study (1-3)
Prerequisite: Three credits in women's studies courses and permission of department. Research and writing or specific readings on a topic selected by the student and supervised by a faculty member of the Women's Studies Program.

WMST 699 Independent Study (1-3)
Prerequisite: permission of instructor. Research and writing on specific readings on a topic selected by the student which is approved and supervised by a faculty member of the Women's Studies Program.

WMST 708 Research Seminar in Women's Studies (3)
Prerequisite: Graduate student standing and permission of instructor. Repeatable to 6 credits if content differs. This seminar provides an opportunity for those students interested in pursuing feminist research teaching to synthesize and explore feminist analyses of university life, including research and writing methods, learning styles, curricular issues, and the "chilly climate" for women.

ZOOL – Zoology

Some of these courses may require the use of animals. See the statement on Animal Care and Use in the appendix and the policy statement for students under degree requirements.

ZOOL 411 Cell Biology (4)
Three hours of lecture and four hours of laboratory per week. *Prerequisites: [ZOOL 211; and CHEM 233] or permission of department.* The molecular and biochemical basis of cell structure and of integrated functions of the subcellular organelles, with an emphasis on eukaryotes.

ZOOL 413 Biophysics (3)
Prerequisite: ZOOL 211; and [PHYS 122 or PHYS 142]; and [MATH 140 or MATH 220]. An introduction to the ideas and methods used in biophysics to analyze the functional components of cells and tissues as physical-chemical systems.

ZOOL 415 Cell Differentiation (3)
Prerequisite: ZOOL 211 or ZOOL 213. The processes by which cells become differentiated from each other during development, with an emphasis on the biochemical and ultrastructural mechanisms of these changes.

ZOOL 416 Biology of Cancer (3)
Prerequisites: ZOOL 211; and [MICB 200 or a course in biochemistry]. Causes and consequences of neoplastic transformations at the biochemical and cellular levels.

ZOOL 421 Neurophysiology (4)
Three hours of lecture and three hours of laboratory per week. *Prerequisites: ZOOL 211; and CHEM 233; and PHYS 122.* The physiology of nerves, muscles and sensory receptors and aspects of central nervous system physiology.

ZOOL 422 Vertebrate Physiology (4)
Three hours of lecture and three hours of laboratory per week. *Prerequisite: ZOOL 211 and one semester of organic chemistry or permission of department.* A study of the cardiovascular,

hemopoietic, gastrointestinal, renal and respiratory systems. Chemical and endocrine regulation of physiological functions in higher vertebrates with emphasis on mammals.

ZOOL 425 Computer Simulation and Modeling of Biological Systems (4)
Prerequisite: permission of department. Students will be expected to have a 300-400 level majors course in BCHM, BOTN, ENTM, MICB or ZOOL, and one semester of calculus. No prior knowledge of computers or programming required. The use of computers as creative research tools in biology to study compartmental analysis, biological oscillations, chaos, fractals, and cellular automata.

ZOOL 426 General Endocrinology (3)
Prerequisites: ZOOL 211; and CHEM 233; and CHEM 243. Functions and the functioning of the endocrine glands of animals with special reference to the vertebrates.

ZOOL 430 Developmental Biology (3)
Prerequisite: ZOOL 211 or ZOOL 213. Structural, functional and regulatory events and mechanisms that operate during development to produce an integrated, multicellular organism composed of a multitude of differentiated cell types.

ZOOL 431 Advanced Developmental Biology (3)
Prerequisite: ZOOL 211; and ZOOL 213, and an upper division course in cell biology or developmental biology. A study of the progression of selected problems in developmental biology from their origins in classical experimental embryology to their current status in modern developmental biology, through analysis of original articles and experimental results.

ZOOL 440 Evolution (3)
Prerequisites: ZOOL 210; and ZOOL 213; and BIOL 106. A consideration of current thought in regard to the evolution of living organisms.

ZOOL 444 Advanced Evolutionary Biology (3)
Prerequisites: ZOOL 440 or equivalent; MATH 140 or MATH 220. The nature and consequences of organic evolution in relation to present day geography and geologic time. Topics covered will include organic diversity gradients in space and time, rates of evolution, co-evolution and extinctions. Particular emphasis will be placed on the synthesis of information and on construction and evaluation of hypotheses.

ZOOL 446 Molecular Genetics (3)
Prerequisites: a course in genetics (e.g. ZOOL 213) and CHEM 233. The molecular basis of gene structure and function. Regulation of differential gene expression.

ZOOL 452 Recombinant DNA (3)
Prerequisite: ZOOL 211 or ZOOL 213 or MICB 380. An advanced course presenting the tools and procedures of genetic engineering. Theory and practical applications of recombinant DNA techniques to understanding eukaryotic gene structure and expression.

ZOOL 455 General Immunology (3)
Prerequisites: ZOOL 211; ZOOL 213. Credit will be granted for only one of the following: ZOOL 455 and MICB 450. Basic principles of immunobiology, immunochemistry and immunogenetics with emphasis on the cellular and molecular basis of the immune response: cells of the immune system and their development, interactions and physiologic environment; the antibody response and interaction with antigen; cell mediated immunity; genetic regulation of the immune response; and the relationship of the immune system to disease.

ZOOL 460 Ethology (3)
Prerequisites: BIOL 106; and ZOOL 213. Study of animal behavior with emphasis on its evolution and function. Topics include: communication, foraging, cooperation and mate selection.

ZOOL 461 Ethology Laboratory (3)
One hour of lecture and six hours of laboratory per week. *Pre) or corequisite: ZOOL 460 or equivalent.* Training in the description of behavior, methods of quantification and experimentation, and the mathematical treatment of behavioral data.

ZOOL 465 Behavioral Ecology (4)
Three hours of lecture and two hours of laboratory per week. *Prerequisites: [BIOL 106 or ZOOL 212]; and ZOOL 213.* Natural and social environments' effect on individual behavior. The influence of evolution on patterns of individual adaptation. Use of the evolutionary paradigm to investigate specific problems in animal and human behavior.

ZOOL 468 Experimental Behavioral Endocrinology (2)
One hour of lecture and six hours of laboratory per week. *Prerequisite: ZOOL 368 or permission of department. Repeatable to 4 credits.*

ZOOL 470 Advanced Animal Ecology (2)
Prerequisites: BIOL 106; and MATH 220; and a course in statistics. Theory of population growth and regulation, life tables and population projection theory of competition and predation, diversity analysis and island geography. Emphasis on current literature and research in ecological theory.

ZOOL 471 Laboratory and Field Ecology (2)
Four hours of laboratory and field work per week. *Pre- or corequisite: ZOOL 470.* Laboratory and field exercises involving problems of contemporary ecological interest; population density regulation, community structure, and spatial pattern diversity in both terrestrial and aquatic systems. Topics coordinated with those presented in ZOOL 470.

ZOOL 472 Protozoology (4)
Prerequisite: one year of biology. Two hours of lecture and six hours of laboratory including field trips per week. Basic conceptual treatment of free-living and parasitic protozoan functional morphology, life history, and systematics. The laboratory will stress observations of protozoa, living and stained, collected from diverse habits.

ZOOL 473 Marine Ecology (3)
Prerequisites: a course in invertebrate zoology or animal diversity, and ZOOL 470, or permission of department. Courses in evolution and animal behavior are strongly recommended. A detailed analysis of the evolutionary ecology of marine invertebrates; emphasis on testing of theories and on current literature.

ZOOL 477 Symbiology (3)
Prerequisite: ZOOL 210 or ZOOL 212. An introduction to basic concepts of symbiosis, with emphasis on coevolution between symbiotic organisms. Adaptations for establishment and maintenance of mutualistic, commensal and parasitic associations. Emphasis on current literature and a research perspective.

ZOOL 480 Aquatic Biology (4)
Two hours of lecture and six hours of laboratory per week. *Prerequisites: BIOL 106; and ZOOL 210.* Relationships of freshwater and estuarine biotic communities to their environment.

ZOOL 481 The Biology of Marine and Estuarine Invertebrates (4)
Two hours of lecture and six hours of laboratory per week. *Prerequisite: one year of zoology including ZOOL 210 or equivalent.* A study of the taxonomy and functional morphology of the invertebrates, exclusive of insects. Emphasis on the study of living material.

ZOOL 482 Marine Vertebrate Zoology (4)
Two hours of lecture and six hours of laboratory per week. *Prerequisite: two hours of zoology including ZOOL 210 and ZOOL 213.* A consideration of the evolution, taxonomy, morphology, physiology, behavior and ecology of marine and estuarine protochordates and vertebrates.

ZOOL 483 Vertebrate Zoology (4)
Two hours of lecture and six hours of laboratory per week. *Prerequisite: BIOL 106 or ZOOL 212.* The identification, classification, habits, and behavior of vertebrates with emphasis on fresh water, terrestrial and aerial forms, and a consideration of the evolution of living and fossil representatives.

ZOOL 495 Mammalian Histology (4)
Two hours of lecture and six hours of laboratory per week. *Prerequisites: ZOOL 211; and ZOOL 422; or permission of department.* A study of the microscopic anatomy, ultrastructure and histophysiology of tissues and organs of mammals.

ZOOL 608 Zoology Seminar (1-2)
Repeatable to a maximum of 8 credits.

ZOOL 609 Special Problems in Zoology (1-6)
Repeatable to 6 credits. One seminar per week for each subject selected: A-Cell biology; B-Developmental biology; C-Estuarine and marine biology; D-Genetics; E-Parasitology; F-Physiology; G-Systematics and Evolutionary biology; I-Behavior; J-General; K-Endocrinology; L-Ecology.

ZOOL 612 Electron Microscopy Laboratory I (3)
Prerequisites: a lecture course in electron microscopy and permission of instructor. Two three-hour laboratories per week and additional arranged time. Preparation and study of biological material by electron microscopy.

ZOOL 613 Electron Microscopy Laboratory II (2)
Six hours of laboratory per week. *Prerequisites: ZOOL 612 or or equivalent and permission of instructor.* A directed individual research project that uses the techniques of electron microscopy to study biological materials.

ZOOL 615 Biological Ultrastructure (3)
Prerequisite: cell biology or histology, or permission of instructor. The ultrastructure of cells and tissues, with emphasis on interpretation and correlation of ultrastructure and function.

ZOOL 621 Comparative Physiology (4)
Three hours of lecture and three hours of laboratory per week. *Prerequisites: one year of zoology and one year of organic chemistry, and one semester of physiology.* The study of the differences and similarities in the functioning of organs of species of the animal kingdom.

ZOOL 622 Membrane Transport Phenomena (3)
Prerequisites: ZOOL 422 or equivalent training in physiology; and knowledge of calculus; or permission of instructor. The fundamental phenomena related to solute movement in bulk solution and across interfaces. Examination of natural and artificial membrane transport systems, with emphasis placed on their mechanism of action.

ZOOL 627 Behavioral Endocrinology (3)
Prerequisite: ZOOL 326 or ZOOL 426. The interactive effects of hormones and behavior. Emphasis on the reproductive and stress hormones as they affect the brain and behavior.

ZOOL 640 Population Genetics (4)
Two hours of lecture and six hours of laboratory per week. *Prerequisite: a course in genetics.* The role of mutation, selection, migration, inbreeding, and stochastic process in evolution.

ZOOL 642 Developmental Genetics (3)
Prerequisites: courses in molecular genetics and developmental biology or cell biology or permission of instructor. Differential gene function and its regulation in developing systems. Genes and the analysis of developmental processes.

ZOOL 665 Sociobiology (4)
Two hours of lecture and six hours of laboratory per week. *Prerequisites: a course in behavior and permission of instructor.* Deals with the description and analysis of animal social organiza-

tions, the adaptive nature of animal societies, the effects of early experience, and the role of communication in the integration of animal groups.

ZOOL 670 Concepts in Animal Ecology (4)
Three hours of lecture and two hours of discussion/recitation per week. Prerequisite: a course in ecology (ZOOL 470 or equivalent). A graduate-level treatment of ecological processes and their evolutionary implications. Review of classical and contemporary literature, with emphasis on current developments in ecological theories, and their testing in the laboratory and in the field.

ZOOL 674 Quantitative Field Ecology (4)
Prerequisites: animal or plant ecology, statistics, and permission of instructor. One full day per week. Group-oriented formulation of hypotheses, collection of data, analysis and discussion of results. Current problems in community and population ecology to be studied in the field. Extended field trips.

ZOOL 676 Behavioral Ecology (4)
Two hours of lecture and six hours of laboratory per week. *Prerequisites: a course in ecology and a course in behavior, or permission of instructor.* The role of interactions among organism and environment upon the dynamics and resource utilization of animals.

ZOOL 677 Ecology of Marine Communities (4)
Two hours of lecture and six hours of laboratory per week. *Prerequisites: ZOOL 670 or permission of instructor. Recommended: ZOOL 481.* An evaluation and extension of our current knowledge of marine communities and how their component populations are limited and interact with one another.

ZOOL 686 Marine and Estuarine Protozoa (4)
Two hours of lecture and six hours of laboratory per week. *Prerequisite: permission of instructor.* An in-depth study of the taxonomic and morphological diversities, life histories, and autecologies of the protozoan fauna of marine and estuarine environments. Special emphasis will be placed on Chesapeake Bay forms. Field work will be an integral part of the laboratory, and shipboard experience is anticipated. Offered in alternate years.

ZOOL 708 Advanced Topics in Zoology (1-4)
Lectures, experimental courses and other special instructions in various zoological subjects. Repeatable four times if the contents are different.

ZOOL 799 Master's Thesis Research (1-6)

ZOOL 899 Doctoral Dissertation Research (1-8)

Faculty Listing

Aaron, Henry J.
Professor, Part-time, Economics. B.A., University of California (Los Angeles), 1958; M.A., Harvard University, 1960; Ph.D., 1963.

Abdelhamid, Mohamed K.
Assistant Professor, Mechanical Engineering. B.Sc., Cairo University, 1974; M.S., Iowa State University, 1979; Ph.D., 1981.

Abed, Eyad H.
Associate Professor, Electrical Engineering; Associate Professor, Systems Research Center. B.S., Massachusetts Institute of Technology, 1979; M.S., University of California (Berkeley), 1981; Ph.D., 1982.

Abraham, Katherine
Associate Professor, Economics. B.S., Iowa State University, 1976; Ph.D., Harvard University, 1982.

Adams, Jeffrey D.
Assistant Professor, Mathematics. B.A., Johns Hopkins University, 1977; Ph.D., Yale University, 1981.

Adams, John Q., III
Professor, Economics. A.B., Oberlin College, 1960; Ph.D., University of Texas, 1965.

Adams, William W.
Professor, Mathematics. B.A., University of California (Los Angeles), 1959; Ph.D., Columbia University, 1964.

Ades, Ibrahim Z.
Associate Professor, Zoology. B.A., University of California (Los Angeles), 1971; Ph.D., 1976.

Adler, Isidore
Professor Emeritus, Chemistry and Biochemistry. B.S., Brooklyn College, 1942; M.S., Brooklyn Polytechnic Institute, 1947; Ph.D., 1952.

Agar, Michael H.
Professor, Anthropology. A.B., Stanford University, 1967; Ph.D., University of California (Berkeley), 1971.

Aggour, M. Sherif
Professor, Civil Engineering. B.S., Cairo University, 1964; M.S., 1966; Ph.D., University of Washington, 1972.

Agrawala, Ashok K.
Professor, Computer Science; Professor, Institute for Advanced Computer Studies. B.S., Agra University, 1960; B.E., Indian Institute of Science, 1963; M.E., 1965; Ph.D., Harvard University, 1970.

Agre, Gene P.
Associate Professor, Education Policy, Planning, and Administration. B.A., Macalester College, 1951; B.S., University of Minnesota, 1953; M.A., 1956; Ph.D., University of Illinois (Urbana), 1964.

Aguilar-Mora, Jorge
Associate Professor and Graduate Director, Spanish and Portuguese. B.A., Universidad Nacional de Mexico, 1966; Ph.D., El Colegio de Mexico, 1976.

Ahad, Rafiul
Assistant Professor, College of Business and Management. B.Sc., Burma Arts and Science University, 1973; M.Sc., 1975; M.Sc., Asian Institute of Technology, 1980; Ph.D., University of Southern California, 1985.

A'Hearn, Michael F.
Professor, Physics and Astronomy, Astronomy Program. B.S., Boston College, 1961; Ph.D., University of Wisconsin, 1966.

Ahrens, Richard A.
Professor, Human Nutrition and Food Systems. B.S., University of Wisconsin, 1958; Ph.D., University of California (Davis), 1963.

Alavi, Maryam
Associate Professor, College of Business and Management. B.A., State University of New York at Buffalo, 1972; M.S., Ohio State University, 1974; Ph.D., 1978.

Albrecht, Pedro
Professor, Civil Engineering. Dipl. Ing., Federal Institute of Technology (Switzerland), 1962; Ph.D., Lehigh University, 1972.

Alexander, James C.
Professor, Mathematics. B.A., Johns Hopkins University, 1964; Ph.D., 1968.

Alexander, Linda
Assistant Professor, Health Education. BSN, University of Maryland, 1972; M.S.Ed., University of Southern California, 1977; MSN, University of Texas, 1980; Ph.D., University of Maryland, 1988.

Alexander, Millard H.
Professor and Associate Director, Chemistry and Biochemistry; Professor and Associate Director, Chemical Physics. B.A., Harvard, 1964; Ph.D., University of Paris, 1967.

Alexander, Pamela
Assistant Professor, Psychology. B.A., Wake Forest University, 1974; M.A., Emory University, 1978; Ph.D., 1980.

Alford, C. Fred
Associate Professor, Government and Politics. B.A., Austin College, 1969; M.A., University of Texas, 1971; Ph.D., 1979.

Ali, Abdul
Assistant Professor, College of Business and Management. Bachelor of Technology, Indian Institute of Technology, 1978; M.B.A., Indian Institute of Management, 1980; Ph.D., Purdue University, 1988.

Allan, J. David
Professor, Zoology. B.Sc., University of British Columbia, 1966; M.S., University of Michigan, 1968; Ph.D., 1971.

Allen, LaRue
Associate Professor, Psychology. A.B., Radcliffe College, 1972; M.S., Yale University, 1977; Ph.D., 1980.

Allen, Redfield W.
Professor, Part-time, Mechanical Engineering. B.S., University of Maryland, 1943; M.S., 1949; Ph.D., University of Minnesota, 1959.

Allen, Roger J.
Associate Professor, Health Education. B.S.E., University of Kansas, 1976; M.S., 1977; Ph.D., University of Maryland, 1979.

Alley, Carroll O., Jr.
Professor, Physics and Astronomy. B.S., University of Richmond, 1948; M.A., Princeton University, 1951; Ph.D., 1962.

Almenas, Kazys K.
Associate Professor, Chemical and Nuclear Engineering. B.S., University of Nebraska, 1957; Ph.D., University and Polytechnic of Warsaw, 1968.

Almon, Clopper, Jr.
Professor, Economics. A.B., Vanderbilt University, 1956; Ph.D., Harvard University, 1962.

Aloimonos, John
Assistant Professor, Computer Science; Assistant Professor, Institute for Advanced Computer Studies. B.S., University of Athens (Greece), 1981; M.S., University of Rochester, 1984; Ph.D., 1986.

Alston-Mills, Brenda
Assistant Professor, Animal Sciences. A.B., Lycoming College, 1967; M.Sc., Michigan State University, 1972; Ph.D., 1984.

Alt, Frank B.
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Zipoy, David M.
Associate Professor, Physics and Astronomy, Astronomy Program. B.S., University of Minnesota, 1954; Ph.D., 1957.

Zorn, Gus T.
Professor, Physics and Astronomy. B.S., Oklahoma State University, 1948; M.S., University of New Mexico, 1950; Ph.D., University of Padua, 1954.

Zwanzig, Robert W.
Professor Emeritus, Institute for Physical Science and Technology. B.S., Polytechnic Institute of Brooklyn, 1948; M.S., University of Southern California, 1950; Ph.D., California Institute of Technology, 1952.

Appendices

University Policy Statements

The provisions of this publication are not to be regarded as an irrevocable contract between the student and the University of Maryland. Changes are effected from time to time in the general regulations and in the academic requirements. There are established procedures for making changes, procedures that protect the institution's integrity and the individual student's interest and welfare. A curriculum or graduation requirement, when altered, is not made retroactive unless the alteration is to the student's advantage and can be accommodated within the span of years normally required for graduation. When the actions of a student are judged by competent authority, using established procedure, to be detrimental to the interests of the university community, that person may be required to withdraw from the university.

It is university policy that smoking in classrooms is prohibited unless all participants agree to the contrary. Any student has the right to remind the instructor of this policy throughout the duration of the class.

Animal Care and Use Program — College Park Campus

The University of Maryland at College Park (UMCP) has an Animal Care and Use Program to ensure appropriate humane care and use of animals in teaching, research and other University functions. This program is consistent with federal and state animal welfare laws. The animal care program is directred by the Animal Care and Use Committee (ACUC) whose members include: animal researchers, veterinarians, individuals who do not use animals and individuals not affiliated with the campus who represent the concerns of the community. Assisted by the Director of Laboratory Animal Care, the ACUC applies the various animal welfare and humane guidelines governing the use of animals on campus. Thus, no animals may be used on the College Park campus for research, teaching or other University functions without prior approval of the ACUC. Approval is granted only after satisfactory review by the ACUC of a submitted animal use protocol. Protocol review is based on the U.S. Interagency Research Animal Committee's "Principles for the Use of Animals in Research Teaching and Testing." According to these principles, each protocol is evaluated with respect to: 1) justification for the use of the animals; 2) rationale for the animal species used; 3) justification of the number of animals used; 4) appropriate and humane animal care and use procedures; and 5) appropriate use of anesthetics and analgesics. The ACUC also conducts frequent inspections of animal facilities, provides training in animal- use procedures and responds to concerns about animal care and use on campus. The guidelines established by the ACUC are published in the University of Maryland at College Park Guidelines for Animal Use on Campus. Any questions or concerns about animal care and use should be directed to the Director of Laboratory Animal Care, Central Animal Resources Facility.

Policies on Nondiscrimination

The University of Maryland is an equal opportunity institution with respect to both education and employment. The University's policies, programs and activities are in conformance with pertinent federal and state laws and regulations on non-discrimination regarding race, color, religion, age, national origin, sex and handicap. Inquiries regarding compliance with Title VI of the Civil Rights Act of 1964, as amended, Title IX of the 1972 Education Amendments, Section 504 of the Rehabilitation Act of 1973 or related legal requirements should be directed to the appropriate individual designated below.

Director, Human Relations Program
Main Administration Building
UMCP

Resolution on Academic Integrity

May 8, 1981 WHEREAS, it is the responsibility of the University of Maryland to maintain integrity in teaching and learning as a fundamental principle on which a university is built; and
WHEREAS, all members of the university community share in the responsibility for academic integrity; therefore
BE IT RESOLVED, that the University of Maryland Board of Regents hereby adopts the following statement of Faculty, Student and Institutional Rights and Responsibilities for Academic Integrity.

Statement of Faculty, Student and Institutional Rights and Responsibilities for Academic Integrity

Preamble At the heart of the academic enterprise are learning, teaching and scholarship. In universities these are exemplified by reasoned discussion between student and teacher, a mutual respect for the learning and teaching process and intellectual honesty in the pursuit of new knowledge. In the traditions of the academic enterprise, students and teachers have certain rights and responsibilities that they bring to the academic community. While the following statements do not imply a contract between the teacher or the University and the student, they are nevertheless conventions that the University believes to be central to the learning and teaching process.

Faculty Rights and Responsibilities

1. Faculty shall share with students and administration the responsibility for academic integrity.
2. Faculty are accorded freedom in the classroom to discuss subject matter reasonably related to the course. In turn they have the responsibility to encourage free and honest inquiry and expression on the part of student.
3. Faculty are responsible for the structure and content of their courses, but they have the responsibility to present courses that are consistent with their descriptions in the University catalog. In addition, faculty have the obligation to make students aware of the expectations in the course, the evaluation procedures and the grading policy.

4. Faculty are obligated to evaluate students fairly and equitably in a manner appropriate to the course and its objectives. Grades shall be assigned without prejudice or bias.
5. Faculty shall make all reasonable efforts to prevent the occurrence of academic dishonesty through the appropriate design and administration of assignments and examinations, and through regular reassessment of evaluation procedures.
6. When instances of academic dishonesty are suspected, faculty shall have the right and responsibility to see that appropriate action is taken in accordance with University regulations.

Student Rights and Responsibilities

1. Students shall share with faculty and administration the responsibility for academic integrity.
2. Students shall have the right of inquiry and expression in their courses without prejudice or bias. In addition, students shall have the right to know the requirements of their courses and to know the manner in which they will be evaluated and graded.
3. Students shall have the obligation to complete the requirements of their courses in the time and manner prescribed and to submit to evaluation of their work.
4. Students shall have the right to be evaluated fairly and equitably in a manner appropriate to the course and its objectives.
5. Students shall not submit as their own work any work which has been prepared by others. Outside assistance in the preparation of this work, such as librarian assistance, tutorial assistance, typing assistance, or such assistance as may be specified or approved by the instructor is allowed.
6. Students shall make all reasonable efforts to prevent the occurrence of academic dishonesty. They shall by their own example encourage academic integrity and shall themselves refrain from acts of cheating and plagiarism or other acts of academic dishonesty.
7. When instances of academic dishonesty are suspected, students shall have the right and responsibility to bring this to the attention of the faculty or other appropriate authority.

Institutional Responsibility

1. Campuses or appropriate administrative units of the University of Maryland shall take appropriate measures to foster academic integrity in the classroom.
2. Campuses or appropriate administrative units shall take steps to define acts of academic dishonesty, to insure procedures for due process for students accused or suspected of acts of academic dishonesty, and to impose appropriate sanctions on students guilty of acts of academic dishonesty.

3. Campuses or appropriate administrative units shall take steps to determine how admission or matriculation shall be affected by acts of academic dishonesty on another campus or at another institution. No student suspended for disciplinary reasons at any campus or the University of Maryland shall be admitted to any other University of Maryland campus during the period of suspension.

AND, BE IT FURTHER RESOLVED, that campuses or appropriate administrative units of the University of Maryland will publish the above Statement of Faculty, Student and Institutional Rights and Responsibilities for Academic Integrity in faculty handbooks and in student handbooks and catalogs; and

BE IT FURTHER RESOLVED, that the Board of Regents hereby directs each campus or appropriate administrative unit to review existing procedures or to implement new procedures for carrying out the institutional responsibilities for academic integrity cited in the above Statement; and

BE IT FINALLY RESOLVED, that the Board of Regents hereby directs each campus or appropriate administrative unit to submit to the President or a designee for approval the campus' or unit's procedure for implementation of the institutional responsibility provisions of the above Statement.

Code of Student Conduct

A Code of Student Conduct was adopted by the Board of Regents on January 25, 1980, and is applicable to both graduate and undergraduate students. The Code is reproduced in the ***Undergraduate Catalog*** and is available in the Office of the Dean for Graduate Studies and Research and in the Office of Judicial Programs.

Charges of academic dishonesty are handled by the Graduate School, and procedural guidelines for dealing with these matters are available in the Dean's Office.

University Policy on Disclosure of Student Records

(Buckley Amendment)

The University of Maryland adheres to a policy of compliance with the Family Educational Rights and Privacy Act (Buckley Amendment). As such, it is the policy of the University (1) to permit students to inspect their education records, (2) to limit disclosure to others of personally identifiable information from education records without students' prior written consent, and (3) to provide students the opportunity to seek correction of their education records where appropriate.

I. Definitions

A. "Student" means an individual who is or who has been in attendance at the University of Maryland. It does not include an applicant for admission to the University who does not matriculate, even if he or she previously attended the University. (Please note, however, that such an applicant would be considered a "student" with respect to his or her records relating to that previous attendance.)

B. "Education records" include those records which contain information directly related to a student and which are maintained as official working files by the University. The following are not educational records:

1. records about students made by professors and administrators for their own use and not shown to others;
2. campus police records maintained solely for law enforcement purposes and kept separate from the education records described above;
3. employment records, except where a currently enrolled student is employed as a result of his or her status as a student;
4. records of a physician, psychologist, or other recognized professional or paraprofessional made or used only for treatment purposes and available only to persons providing treatment. However, these records may be reviewed by an appropriate professional of the student's choice;
5. records which contain only information relating to a person's activities after that person is no longer a student at the University.

II. It is the policy of the University of Maryland to permit students to inspect their education records.

A. **Right of Access**

Each student has a right of access to his or her education records, except confidential letters of recommendation received prior to January 1, 1975, and financial records of the student's parents.

B. **Waiver**

A student may, by a signed writing, waive his or her rights of access to confidential recommendations in three areas: admission to an educational institution, job placement and receipt of honors and awards. The University will not require such waivers as a condition for admission or receipt of any service or benefit normally provided to students. If the student chooses to waive his or her right of access, he or she will be notified, upon written request, of the names of all persons making confidential recommendations. Such recommendations will be used only for the purpose for which they were specifically intended. A waiver may be revoked in writing at any time, and the revocation will apply to all subsequent recommendations, but not to recommendations received while the waiver was in effect.

C. **Types and Locations of Education Records, Titles of Records Custodians**

Please note that all requests for access to records should be routed through the Registrations Office (see II.D below).

1. **Admissions**

Applications and transcripts from institutions previously attended.

a. Undergraduate-Director of Undergraduate Admissions, North Administration.

b. Graduate-Director of Graduate Records, South Administration.

2. **Registrations**
All on-going academic and biographical records. Graduate and Undergraduate-Director of Registrations, North Administration.

3. **Departments**
Departmental offices: the Department Chair (Check first with the Director of Registrations.) (Miscellaneous records kept vary with the department.)

4. **Deans and Provosts**
Deans and Provosts offices of each school. Miscellaneous records.

5. **Resident Life**
North Administration, Director of Resident Life. Student's housing records.

6. **Advisers**
Pre-law Adviser: Undergraduate Library. Pre-dental Adviser: Turner Laboratory. Pre-Medical Adviser: Turner Laboratory. Letters of evaluation, personal information sheet, transcript, test scores (if student permits).

7. **Judicial Affairs**
North Administration Building. Director of Judicial Affairs. Students' judicial and disciplinary records.

8. **Counseling Center**
Shoemaker Hall, Director.
Biographical data, summaries of conversations with student, test results. (Where records are made and used only for treatment purposes, they are not education records and are not subject to this policy.)

9. **Financial Aid**
   a. Undergraduate-North Administration, Director of Financial Aid.

   b. Graduate and Professional School-Located in Dean's Offices. Financial aid applications, need analysis statements, awards made (no student access to parents' confidential statements).

10. **Career Development Center**
Terrapin Hall, Director. Recommendations, copies of academic records, (unofficial) (not WAIVER section).

11. **Business Services**
South Administration Building, Director. All student accounts receivable, records of students' financial charges and credits with the University.

D. **Procedures to be Followed**
Requests for access should be made in writing to the Office of Registrations. The University will comply with a request for access within a reasonable time, at least within 45 days. In the usual case, arrangements will be made for the students to read his or her records in the presence of a staff member. If facilities permit, a student may ordinarily obtain copies of his or her records by paying reproduction costs. The fee for copies is $.25 per page. No campus will provide copies of any transcripts in the student's records other than the student's current University transcript from that campus. Official University transcripts (with University seal) will be provided at a higher charge.

III. It is the policy of the University of Maryland to limit disclosure of personally identifiable information from education records unless it has the student's prior written consent, subject to the following limitations and exclusions.

a. **Directory Information**

1. The following categories of information have been designated directory information:
   Name
   Address
   Telephone listing
   Date and place of birth
   Photograph
   Major field of study
   Participation in officially recognized activities and sports
   Weight and height of members of athletic teams
   Dates of attendance
   Degrees and awards received
   Most recent previous education institution attended
2. This information will be disclosed even in the absence of consent unless the student files written notice informing the University not to disclose any or all the categories within three weeks of the first day of the semester in which the student begins each school year. This notice must be filed annually within the above allotted time to avoid automatic disclosure of directory information. The notice should be filed with the campus registration office. See II.C
3. The University will give annual public notice to students of the categories of information designated as directory information.
4. Directory information may appear in public documents and otherwise disclosed without student consent unless the student objects as provided above.

B. **Prior Consent not Required**

Prior consent will not be required for disclosure of education records to the following parties:

1. School officials of the University of Maryland who have been determined to have legitimate educational interests;
   a. "School officials" include instructional or administrative personnel who are or may be in a position to use the information in furtherance of a legitimate objective;
   b. "Legitimate educational interests" include those interests directly related to the academic environment;
2. Officials of other schools in which a student seeks or intends to enroll or is enrolled. Upon request, and at his or her expense, the student will be provided with a copy of the records which have been transferred;
3. Authorized representatives of the Comptroller General of the U.S., the Secretary of HEW, the Commissioner of the Office of Education, the Director of the National Institute of Education, the Administrator of the Veterans' Administration, the Assistant Secretary of HEW for Education and State educational authorities, but only in connection with the audit or evaluation of federally supported education programs, or in connection with the enforcement of or compliance with federal legal requirements relating to these programs. Subject to controlling federal law or prior consent, these officials will protect information received so as not to permit personal identification of students to outsiders;
4. Authorized persons and organizations which are given work in connection with a student's application for, or receipt of, financial aid, but only to the extent necessary for such purposes as determining eligibility, amount, conditions and enforcement of terms and conditions.
5. State and local officials to which such information is specifically required to be reported by effective state law adopted prior to November 19, 1974;
6. Organizations conducting educational studies for the purposes of developing, validating or administering predictive tests, administering student aid programs and improving instruction. The studies shall be conducted so as not to permit personal identification of students to outsiders, and the information will be destroyed when no longer needed for these purposes;
7. Accrediting organizations for purposes necessary to carry out their functions;
8. Parents of a student who is a dependent for income tax purposes. (Note: The University may require documentation of dependent status such as copies of income tax forms.)

9. Appropriate parties in connection with an emergency, where knowledge of said information is necessary to protect the health or safety of the student or other individuals;
10. In response to a court order or subpoena. The University will make reasonable efforts to notify the student before complying with the court order.

C. **Prior Consent Required**
In all cases, the University will not release personally identifiable information in education records or allow access to those records without prior consent of the student. Unless disclosure is to the student himself or herself, the consent must be written, signed and dated and must specify the records to be disclosed, the identity of the recipient and the purpose of the disclosure. A copy of the records disclosed will be provided to the student upon request and at his or her expense.

D. **Record of Disclosures**
The University will maintain with the student's education records a record for each request and each disclosure, except for the following:

1. disclosures to the student himself or herself;
2. disclosures pursuant to the written consent of the student (the written consent itself will suffice as a record);
3. disclosures to instructional or administrative officials of the University;
4. disclosures of directory information.
This record of disclosures may be inspected by the student, the official custodian of the records, and other University and governmental officials.

IV. It is the policy of the University of Maryland to provide students the opportunity to seek correction of their education records.

a. **Request to Correct Records**
A student who believes that information contained in his or her education records is inaccurate, misleading or violative of privacy or other rights may submit a written request to the Office of Registrations specifying the document(s) being challenged and the basis for the complaint. The request will be sent to the person responsible for any amendments to the record in question. Within a reasonable period of time of receipt of the request, the University will decide whether to amend the records in accordance with the request. If the decision is to refuse to amend, the student will be so notified and will be advised of the right to a hearing. He or she may then exercise that right by written request to the Office of the Chancellor.

B. **Right to a Hearing**
Upon request by a student, the University will provide an opportunity for a hearing to challenge the content of the student's rec-

ords. A request for a hearing should be in writing and submitted to the Office of Registrations. Within a reasonable time of receipt of the request, the student will be notified in writing of the date, place and time reasonably in advance of the hearing.

1. **Conduct of the hearing**
   The hearing will be conducted by a University official who does not have a direct interest in the outcome. The student will have a full and fair opportunity to present evidence relevant to the issues raised and may be assisted or represented by individuals of his or her choice at his or her expense, including an attorney.
2. **Decision**
   Within a reasonable period of time after the conclusion of the hearing, the University will notify the student in writing of its decision. The decision will be based solely upon evidence presented at the hearing and will include a summary of the evidence and the reasons for the decision. If the University decides that the information is inaccurate, misleading or otherwise in violation of the privacy or other rights of the student, the University will amend the records accordingly.

C. **Right to Place and Explanation in the Records**
   If, as a result of the hearing, the University decides that the information is not inaccurate, misleading or otherwise in violation of the student's rights, the University will inform the student of the right to place in his or her record a statement commenting on the information and/or explaining any reasons for disagreeing with the University's decision. Any such explanation will be kept as part of the student's record as long as the contested portion of the record is kept and will be disclosed whenever the contested portion of the record is disclosed.

V. **Right to File Complaint**

A student alleging University noncompliance with the Family Educational Rights and Privacy Act may file a written complaint with the Family Educational Rights and Privacy Act Office (FERPA), Department of HEW, 330 Independence Avenue, S.W., Washington, D.C. 20201.

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016 Baltimore Hall (Dorm) D-1
099 Bel Air Hall (Dorm) J-5
147 Benjamin Bldg. G-3
119 Blacksmith Shop I-5
235, 236, 305,307 Byrd Stadium Bldgs. K-3
177 Byrd Stadium South Bldg. H-3
178 Byrd Stadium North Bldg. H-3
161 Byrd Stadium Field House H-3
302 Byrd Stadium Press Box I-3
180 Byrd Stadium Concession Bldg. I-3
015 Calvert Hall (Dorm) D-3
095 Cambridge Hall (Dorm) I-4
343 Campus Mail Facility F-6
070 Caroline Hall (Dorm) E-3
065 Carroll Hall (Dorm) E-3
110 Cattle Barn I-5
017 Cecil Hall (Dorm) D-4
345 Center of Adult Education G-2
087 Central Animal Resources Facility I-6
001 Central Heating Plant D-6
206 Central Receiving Warehouse B-7
098 Centreville Hall (Dorm) J-5
164 Chancellor's Residence I-2
025 Charles Hall (Dorm) C-4
090 Chemical and Nuclear Engineering Bldg. H-5
091 Chemistry Bldg. G-5
121 Chesterfield Hall (Dorm) J-4
106 Classroom Bldg. H-6
182 Cole Student Activities Bldg. H-3
224 Computer and Space Sciences Bldg. I-4
122 Cumberland Hall (Dorm) I-4
252 Denton Hall (Dorm) J-3
202 Department of Campus Parking H-5
097 Dining Hall (Cambridge) J-4
251 Dining Hall (Denton) K-3
028 Dining Hall (South Campus) E-3
257 Dining Hall (Elkton) J-4
084 Dorchester Hall (Dorm) D-3
229 East Poultry Laboratory I-4
253 Easton Hall (Dorm) K-3
066 Education Annex, West, E-3
254 Elkton Hall (Dorm) J-3
256 Ellicott Hall (Dorm) J-3
223 Energy Research Facility I-6
088 Engineering Classroom Bldg. G-5
089 Engineering Laboratory Bldg. G-5
093 Engineering Research Bldg. H-6
018 Environmental Safety Office Bldg. B-5
344 Environmental Services Facility K-5
007 Fire and Rescue Institute (M&) I. C-5
158 Football Bldg. H-3
048 Francis Scott Key Hall E-4
126 I-30 Fraternity Houses, C-6
029 Frederick Hall (Dorm) C-4
031 Garrett Hall (Dorm) D-3
299 Gate House F-6
215 General Services Bldg. D-6
257 Geology Bld
160 Golf Course
002 Greenhouse
328 Grounds Ma
056 Grounds Off
124 Grounds Op
254 Hagerstown
014 Harford Hall
002 Harrison Lab
140 Health Cent
074 Houseplex Ha
147 Hornbake Li
108 Horse Barn
112 Hospital Sal
028 Howard Hall
033 Institute of A
085 Institute for
Technology
045 Instructional



034 Jimenez Hall G-3	Z31 Microbiology Bldg. G-4	054 Pearsall Field House F-3	078 Symons Hall F-4		
058 Journalism Bldg. F-3	232 Mill Bldg. G-4	021 Prince Georges Hall (Dorm.) D-4	030 Talbot Hall (Dorm.) D-4		
227 Jull Hall I-4	052 Mitchell Bldg. F-5	061 Queen Anne Hall F-3	043 Taliaferro Hall E-4		
022 Kent Hall (Dorm.) D-4	032 Montgomery Hall (Dorm.) C-4	078 Reckord Armory E-5	141 Tawes Fine Arts Bldg. G-3		
027 Knox Rd. Office Bldg. East, C-4	040 Morrill Hall E-3	004 Ritchie Coliseum D-5	321 322 Temporary Bldgs. G-3		
117 Knox Rd. Office Bldg. West, C-4	011 Motor Transportation Facility D-6	080 Rossborough Inn (Faculty Alumni Club) E-5	053 Temporary Classroom Bldg. AA, D-3		
071 Lee Building E-4	064 Plant Branch Office Bldg. H-6	019 Satellite Centrifuge Utilities Bldg. C-4	058 Temporary Classroom Bldg. EE, D-3		
038 LeFrak Hall E-3	179 Parking Garage #1 H-3	065 Service Building Annex E-6	079 Turner Laboratory (Dairy) E-5		
259 LaPlata Hall (Dorm.) J-4	204 Parking Garage #2 H-5	003 Service Bldg., Plaza D-5	042 Tydings Hall E-3		
250 Leonardtown Community Center B-6	073 Patterson H.J. Hall G-4	109 Sheep Barn I-5	288 292 University Hills Apartments G-1		
238 240 Leonardtown Housing B-6	082 Patterson J.M. Bldg. H-5	159 Shipley Field House (Baseball) H-4	023 Washington Hall (Dorm.) C-4		
261 Leonardtown Office Bldg. B-6	255 Physical Education, Recreation and Health Bldg. I-5	037 Shoemaker Bldg. E-3	228 West Poultry Laboratory I-4		
260 280 Lord Calvert Apartments B-2	100 Physics and Astronomy Research Facility E-6	075 Shriver Lab. F-4	088 Worcester Hall (Dorm.) E-3		
077 Main Administration Bldg. E-4	082 Physics Bldg. G-5	013 Shuttle Bus Facility E-6	115 Williams A.V. Bldg. H-6		
046 Marie Mount Hall E-4	094 Skinner Bldg. E-4	044 Skinner Bldg. E-4	081 Wind Tunnel Bldg. G-6		
084 Mathematics Bldg. G-5	008 Plant Operations and Maintenance Shops D-6	283 Somerset Hall (Dorm.) F-3	041 Woods Hall E-4		
035 McKeldin Library F-3	151 Plant Operations and Maintenance Shops E-6	170 176 Sorority Houses B-5	051 Worchester Hall (Dorm.) F-3		
009 Memorial Chapel E-4	113 Police Substation C-3	062 St. Mary's Hall (Dorm.) G-3	144 Zoology-Psychology Bldg. H-4		
	181 191 Poultry Shelters and Storage Bldgs. I-4	163 Stamp Students Union Bldg. G-4			

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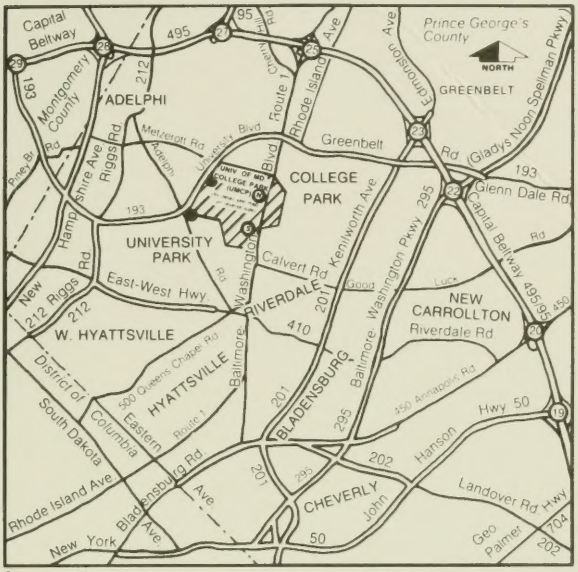
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Area Map and Directions to University of Maryland College Park (UMCP)



R = UMCP North Gate
S = UMCP South Gate

O = Beltway Interchange
● = West Entrances to UMCP

From Baltimore:

I-95 South to Capital Beltway (495), follow signs to College Park, U.S. 1 South (Interchange 25). Proceed approx. 2 mi. south on U.S. 1 to UMCP's North Gate. Right turn into campus.

B-W Parkway (295) south to Greenbelt Rd. (193), west on Greenbelt Rd. to U.S. 1. Take U.S. 1 South to UMCP's North Gate. Right turn into campus.

From Bowie/Annapolis Areas and Points East:

Rt. 50 to Capital Beltway (495), north on 495 to College Park, exit Beltway at Interchange 25 (U.S. 1 South), proceed approx. 2 mi. on U.S. 1. Right turn into campus.

From Montgomery County and Points West:

Capital Beltway (495) to U.S. 1 South (Interchange 25), proceed approx. 2 mi. on U.S. 1. Right turn into UMCP North Gate.

From Washington:

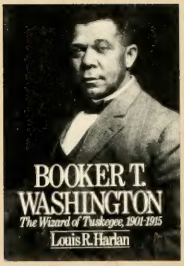
Rhode Island Ave. (U.S. 1 North) to College Park. Enter UMCP by turning left off U.S. 1 at UMCP South Gate.

New Hampshire Ave. (29) or Riggs Rd. (212) to East-West Hwy. (410), right on 410 to Queen's Chapel Rd. (500), left on 500 to U.S. 1. Left on U.S. 1 to UMCP South Gate. Left into campus.

N.Y. Ave. (50) to B-W Pkwy. (295), exit at Riverdale Road West (410), proceed to U.S. 1 and turn right. Continue to College Park. Enter campus by turning left off U.S. 1 at UMCP South Gate.

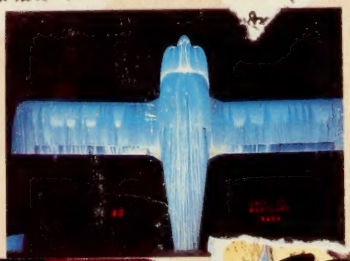
The University's Central Administration is located in the Elkins Building, 3300 Metzerott Road, Adelphi, Md. To reach the Elkins Building from the UMCP campus:

Take U.S. 1 North to University Blvd. (193 West), proceed west on 193 to Metzerott Rd., turn right on Metzerott, right turn off Metzerott into parking lot.


BOOKER T.
WASHINGTON
The Wizard of Tuskegee, 1901-1915
Louis R. Harlan







M

MARYLAND



